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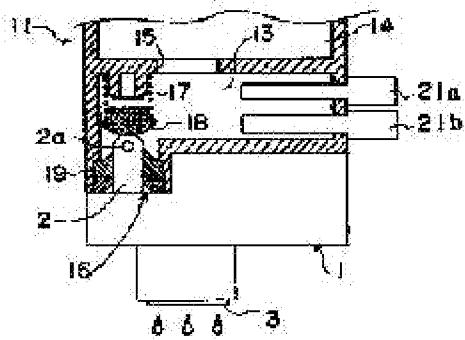
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(54) INK CARTRIDGE, PRINTING HEAD AND INK JET PRINTER

(57)Abstract:

PURPOSE: To prevent the intrusion of foams into a chamber at the time of setting and removing an ink cartridge and carry out the printing of high reliability by providing a valve means in which a connecting section is opened by inserting an ink jet feed pipe into the connecting section to communicate a printing head with a second chamber.



CONSTITUTION: A valve 18 is pressed by an end of a feed pipe 2 and distorted to eliminate a space between the valve 18 and the end of the feed pipe 2. As the shape of a packing 19 corresponds to the shape of the end of the feed pipe 2, no air remains in the vicinity of the valve 18 and the feed pipe 2, and the intrusion of foams into a chamber 13 of an ink cartridge 11 is not generated. The tapered shape of the end of the feed pipe 2 corresponds to the tapered shape of an opening on the lower section of the packing 19, while the lower section of the valve 18 and the upper section of the packing 19 are formed respectively into the half-spherical shape protruded downward and the half-spherical shape recessed upward.

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CLAIMS

[Claim(s)]

[Claim 1] Casing which has the 1st chamber and 2nd chamber which are the ink cartridge with which the print head which has the delivery pipe which receives supply of ink is equipped, are open for free passage through a free passage hole, and store ink, It is prepared in the 2nd chamber and has this delivery pipe and a connectable connection. this -- the porous body for being prepared in the 1st chamber and holding ink with negative pressure -- this -- this connection Usually, the ink cartridge which has a valve means to have closed, to open if this delivery pipe is inserted in this connection, and to open this print head and this 2nd chamber for free passage.

[Claim 2] The part in contact with said delivery pipe of said valve means is an ink cartridge according to claim 1 which has the configuration which a clearance does not produce in the condition that this delivery pipe contacts this valve means.

[Claim 3] For the valve which has the shape of a hemihedry globular form of a convex in the wearing direction over the print head of an ink cartridge, and this wearing direction, said valve means is an ink cartridge according to claim 1 or 2 which consists of packing which has the spherical-surface configuration of concave in an opposite direction, and a spring which forces this valve in the wearing direction to this packing.

[Claim 4] Said valve means is an ink cartridge according to claim 1 or 2 which consists of the valve which has the shape of a hemihedry globular form of a convex in the wearing direction over the print head of an ink cartridge, an O ring, and a spring which forces this valve in the wearing direction to this O ring.

[Claim 5] Said valve and said packing, or said O ring is an ink cartridge according to claim 3 or 4 which a degree of hardness becomes from the spring material which is 40 - 70 degrees, respectively.

[Claim 6] It is an ink cartridge given in any 1 term among claims 1-5 further equipped with two or more electrodes prepared in said 2nd chamber in order to detect the residue of ink.

[Claim 7] It is an ink cartridge given in any 1 term among claims 1-5 which compensate with the fall of the negative pressure holding power of the ink by said porous body accompanying [have further the passage which an end connects with said 1st chamber and the other end connects to said 2nd chamber, and the filter member prepared in the other end of this passage, and] reduction of the residue of ink in this filter member according to the meniscus force.

[Claim 8] The end of said passage is an ink cartridge according to claim 7 in which the other end carries out opening in this predetermined direction and which carries out opening in the predetermined direction opposite to the wearing direction over the print head of an ink cartridge, and connects with said 1st chamber, and it connects to said 2nd chamber.

[Claim 9] Said filter member is an ink cartridge according to claim 7 or 8 which a mesh becomes

from the ingredient of #30-#800.

[Claim 10] Said filter member is an ink cartridge given in any 1 term among claims 7-9 which a contact angle with ink becomes from the ingredient of 5 times or more.

[Claim 11] It is an ink cartridge given in any 1 term among claims 7-10 further equipped with two or more electrodes prepared in said 2nd chamber in order to detect the residue of ink.

[Claim 12] the ink of sufficient amount to perform at least 1-page printing in said 2nd chamber remains in the condition that said electrode detects an ink piece -- as -- this -- the ink cartridge according to claim 11 arranged in the predetermined location in the 2nd chamber.

[Claim 13] It is the print head of the ink jet printer with which it is equipped with the ink cartridge which has casing which has the chamber which stores ink, and the connection which it was prepared in this chamber and has usually been closed. The delivery pipe which is inserted in these connection circles of this ink cartridge, and receives supply of ink, It has a nozzle and the regurgitation energy generation component which carries out the regurgitation of the ink supplied from this delivery pipe through this nozzle. This delivery pipe The print head which has the point of the configuration which does not produce a clearance where this connection is contacted, and 1 or two or more holes which carry out opening into this chamber in the condition of it having been prepared in this point and having been inserted in these connection circles.

[Claim 14] Casing which has the chamber which is mountable/dismountable and stores ink to a print head, It is an ink jet printer using the ink cartridge which has the connection which it was prepared in this chamber and has usually been closed. A carrier, It has the head section which it is attached in this carrier and driven with this carrier. This head section It consists of 1 or two or more print heads. Each print head The delivery pipe which is inserted in these connection circles of this ink cartridge, and receives supply of ink, It has a nozzle and the regurgitation energy generation component which carries out the regurgitation of the ink supplied from this delivery pipe through this nozzle. This delivery pipe The ink jet printer which has the point of the configuration which does not produce a clearance where this connection is contacted, and 1 or two or more holes which carry out opening into this chamber in the condition of it having been prepared in this point and having been inserted in these connection circles.

DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Industrial Application] This invention relates to an ink cartridge, a print head, and an ink jet printer, especially relates to the print head and ink jet printer using the ink cartridge in which desorption is possible, and such an ink cartridge to the print head of an ink jet printer.

[0002]

[Description of the Prior Art] In an ink jet printer, if ink goes out, printing becomes impossible almost momentarily and the so-called dot omission will be started. Then, the residue of ink is always detected, and while suspending printing actuation of an ink jet printer before a dot omission occurs, it is necessary to generate the alarm which demands a supplement of ink from a user. In addition, as the detection approach of the residue of ink, the electrode of a pair is prepared in the ink tank which stores ink, a pulse voltage is impressed so that electrolysis may not be caused between two electrodes, and there is the approach of detecting the residue of ink under supervising resistance change.

[0003] A supplement of ink has troublesome actuation and it is desirable to use the method which exchanges the ink cartridge itself which will contain ink if the above-mentioned alarm is generated also from the field of the running cost of an ink jet printer. The thing of various configurations is proposed as such an ink cartridge.

[0004] Drawing 12 is the side elevation showing an example of the conventional ink cartridge with a print head, and only the ink cartridge in the said drawing is shown by the cross section which removed a part for the upper part. In drawing 12, a print head 501 has the ink needle 503. On the other hand, an ink cartridge 502 has the sponge 506 for generating negative pressure to an elastic member 504, ink 505, and ink 505. It is equipped with an ink cartridge 502 to a print head 501 so that an elastic member 504 may shoot through with the ink needle 503 of a print head 501, and it has structure removed from a print head 501 by actuation contrary to this.

[0005] In anticipated use, an ink cartridge 502 is removed, only when ink goes out and it is exchanged for a new ink cartridge. However, it may mistake, if an ink cartridge 502 is exchanged or ink has run out accidentally by a certain reason, in order to use the ink of a color in which users differ, and an ink cartridge 502 may be removed. Moreover, in case a user performs maintenance, such as cleaning of the print head 501 circumference of an ink jet printer, by himself, also when removing an ink cartridge 502, it thinks.

[0006] When the ink in an ink cartridge 502 removes an ink cartridge 502 from a print head 501 in the condition of having not run out yet, it will be used again, equipping a print head 501 with this same ink cartridge 502. However, after removing an ink cartridge 502 from a print head 501 once, when equipping a print head 501 again, after the path of the ink between a print head 501 and an ink cartridge 502 is severed once, it will be open for free passage again. For this reason, in case the ink needle 503 penetrates an elastic member 504 again, invasion of the air bubbles from the path of the above-mentioned ink to into into a print head 501 and an ink cartridge 502 is not avoided. Even if it is the air bubbles which invaded in the ink cartridge 502, if it is left, any will invade in a print head 501.

[0007]

[Problem(s) to be Solved by the Invention] If air bubbles invade in a print head 501, a dot omission will be started at a certain time. Then, the protection feature of the print head 501 called a backup unit is prepared, in order to prevent a dot omission, a backup unit is used and air bubbles are made to attract and discharge from the nozzle of a print head 501 conventionally. However, since ink excessive with a natural thing will also be discharged together in case air bubbles are made to discharge from a nozzle, whenever it equipped with the ink cartridge 502, using a backup unit had the problem that it was not a best policy in the futility of ink.

[0008] Moreover, when air bubbles invaded in an ink cartridge 502, air bubbles might contact the electrode for detecting the residue of ink, and resistance might change to it. For this reason, in spite of having equipped the print head 501 with a new ink cartridge, there was also a problem that an ink piece might be detected accidentally.

[0009] Furthermore, in case an ink cartridge 502 is removed from a print head 501, to take measures which ink leakage does not produce is desired. Then, in case this invention removes an ink cartridge from a print head, it aims at offering the ink card ridge, print head, and ink jet printer which certainly enable prevention of ink leakage, while they enable reliable printing in the case of the mount/dismount to the print head of an ink cartridge, as air bubbles do not invade in an ink cartridge and a print head.

[0010]

[Means for Solving the Problem] The above-mentioned technical problem is an ink cartridge

with which the print head which has the delivery pipe which receives supply of ink according to claim 1 is equipped. Casing which has the 1st chamber and 2nd chamber which are open for free passage through a free passage hole, and store ink, It is prepared in the 2nd chamber and has this delivery pipe and a connectable connection. this -- the porous body for being prepared in the 1st chamber and holding ink with negative pressure -- this -- this connection Usually, it has closed and the ink cartridge which has a valve means to open if this delivery pipe is inserted in this connection, and to open this print head and this 2nd chamber for free passage can attain.

[0011] In invention according to claim 2, the part in contact with said delivery pipe of said valve means has the configuration which a clearance does not produce in the condition that this delivery pipe contacts this valve means in invention of claim 1. In invention according to claim 3, said valve means consists of packing with which the valve which has the shape of a hemihedry globular form of a convex in the wearing direction over the print head of an ink cartridge, and this wearing direction have the spherical-surface configuration of concave in an opposite direction, and a spring which forces this valve in the wearing direction to this packing in claim 1 or invention of 2.

[0012] In invention according to claim 4, said valve means consists of the valve which has the shape of a hemihedry globular form of a convex in the wearing direction over the print head of an ink cartridge, an O ring, and a spring which forces this valve in the wearing direction to this O ring in claim 1 or invention of 2.

[0013] In invention according to claim 5, said valve and said packing, or said O ring consists of a spring material whose degree of hardness is 40 - 70 degrees in claim 3 or invention of 4, respectively. In invention according to claim 6, among claims 1-5, in order to detect the residue of ink in invention of any 1 term, it had further two or more electrodes prepared in said 2nd chamber.

[0014] At invention according to claim 7, among claims 1-5, in invention of any 1 term, it has further the passage which an end connects with said 1st chamber and the other end connects to said 2nd chamber, and the filter member prepared in the other end of this passage, and this filter member is compensated with the fall of the negative pressure holding power of the ink by said porous body accompanying reduction of the residue of ink according to the meniscus force.

[0015] In invention according to claim 8, in invention of claim 7, opening is carried out in the predetermined direction opposite to the wearing direction over the print head of an ink cartridge, and it connects with said 1st chamber, and the other end carries out opening of the end of said passage in this predetermined direction, and connects it to said 2nd chamber.

[0016] In invention according to claim 9, as for said filter member, a mesh consists of an ingredient of #30-#800 in claim 7 or invention of 8. In invention according to claim 10, as for said filter member, a contact angle with ink consists of an ingredient of 5 times or more in invention of any 1 term among claims 7-9.

[0017] In invention according to claim 11, among claims 7-10, in order to detect the residue of ink in invention of any 1 term, it had further two or more electrodes prepared in said 2nd chamber. by invention according to claim 12, the ink of sufficient amount to perform at least 1-page printing in said 2nd chamber remains in the condition that said electrode detects an ink piece, in invention of claim 11 -- as -- this -- it is arranged in the predetermined location in the 2nd chamber.

[0018] Casing which has the chamber in which the above-mentioned technical problem stores ink according to claim 13, It is the print head of the ink jet printer with which it is equipped with the ink cartridge which has the connection which it was prepared in this chamber and has usually

been closed. The delivery pipe which is inserted in these connection circles of this ink cartridge, and receives supply of ink, It has a nozzle and the regurgitation energy generation component which carries out the regurgitation of the ink supplied from this delivery pipe through this nozzle. This delivery pipe The print head which has the point of the configuration which does not produce a clearance where this connection is contacted, and 1 or two or more holes which carry out opening into this chamber in the condition of it having been prepared in this point and having been inserted in these connection circles can also attain.

[0019] Casing which has the chamber which is mountable/dismountable to a print head according to claim 14 as for the above-mentioned technical problem, and stores ink, It is an ink jet printer using the ink cartridge which has the connection which it was prepared in this chamber and has usually been closed. A carrier, It has the head section which it is attached in this carrier and driven with this carrier. This head section It consists of 1 or two or more print heads. Each print head The delivery pipe which is inserted in these connection circles of this ink cartridge, and receives supply of ink, It has a nozzle and the regurgitation energy generation component which carries out the regurgitation of the ink supplied from this delivery pipe through this nozzle. This delivery pipe The ink jet printer which has the point of the configuration which does not produce a clearance where this connection is contacted, and 1 or two or more holes which carry out opening into this chamber in the condition of it having been prepared in this point and having been inserted in these connection circles can also attain.

[0020]

[Function] Since it can prevent certainly that ink leaks to the exterior of an ink cartridge also in case an ink cartridge is removed from a print head while air bubbles can prevent certainly invading into an ink cartridge or a print head according to invention according to claim 1, in case a print head is equipped with an ink cartridge, it becomes possible to improve the dependability of an ink jet printer.

[0021] According to invention according to claim 2, in case a print head is equipped with an ink cartridge, air bubbles can prevent especially invading into an ink cartridge or a print head certainly. According to invention according to claim 3, with an easy configuration, in case a print head is equipped with an ink cartridge, it can prevent certainly that air bubbles invade into an ink cartridge or a print head.

[0022] According to invention according to claim 4, in case a print head is equipped with an ink cartridge, air bubbles can prevent especially invading into an ink cartridge or a print head certainly. According to invention according to claim 5, it can prevent certainly that a clearance occurs in the condition that a delivery pipe contacts a valve means.

[0023] According to invention according to claim 6, the residue of ink is correctly detectable with high dependability. According to invention according to claim 7, even if the residue of ink decreases, ink can be held with negative pressure.

[0024] According to invention according to claim 8, with an easy configuration, even when there are few residues of ink, ink can be held with negative pressure. According to invention according to claim 9, with an easy configuration, even when there are few residues of ink, ink can be held with negative pressure.

[0025] According to invention according to claim 10, with an easy configuration, even when there are few residues of ink, ink can be held with negative pressure. According to invention according to claim 11, the residue of ink can be correctly detected with high dependability, and the variation in the actual ink residue in the condition of having detected the ink piece can also be abolished.

[0026] Since according to invention according to claim 12 at least 1 page can be completely printed after an ink piece is detected, the situation whose ink is suddenly lost during printing is avoidable. Since according to invention according to claim 13 it can prevent certainly that ink leaks to the exterior of an ink cartridge also in case a dot omission does not arise and an ink cartridge is removed from a print head with an easy configuration, since air bubbles can prevent certainly invading into an ink cartridge or a print head in case a print head is equipped with an ink cartridge, it becomes possible to improve the dependability of an ink jet printer.

[0027] Since according to invention according to claim 14 it can prevent certainly that ink leaks to the exterior of an ink cartridge also in case a dot omission does not arise and an ink cartridge is removed from a print head with an easy configuration, since air bubbles can prevent certainly invading into an ink cartridge or a print head in case a print head is equipped with an ink cartridge, it becomes possible to improve the dependability of an ink jet printer.

[0028] Therefore, since air bubbles can prevent certainly invading into an ink cartridge or a print head in case a print head is equipped with an ink cartridge according to this invention, also in case a dot omission is not produced but an ink cartridge is removed from a print head, since it can prevent certainly, useless consumption of ink is also avoided, and it also becomes possible [improving the dependability and the running cost of an ink jet printer] for ink to leak to the exterior of an ink cartridge.

[0029]

[Example] Drawing 1 is the side elevation showing the 1st example of an ink cartridge which becomes this invention with the 1st example of a print head which becomes this invention. In drawing 1 , a print head 1 has the delivery pipe 2 and nozzle 3 for supplying ink. The ink cartridge 11 is mountable/dismountable to a print head 1 by actuation of a release lever 5. In addition, although illustration is omitted in drawing 1 , in case mount/dismount of the ink cartridge 11 is carried out to a print head 1, it cannot be overemphasized that the guidance device in which an ink cartridge 11 is guided may be established.

[0030] Drawing 2 is the sectional view showing the important section of an ink cartridge 11. A chamber 12 is formed in the upper part of casing of an ink cartridge 11 among this drawing, and the chamber 13 is formed in the lower part of casing. In the chamber 12, the sponge 14 holding the ink in an ink cartridge 11 is contained. Of course, a suitable porous body may be used instead of sponge 14. A chamber 13 holds temporarily the ink supplied to a print head 1. These chambers 12 and 13 are open for free passage through the free passage hole 15.

[0031] In this example, the connection 16 linked to the delivery pipe 2 of a print head 1 is formed in the left-hand side of a chamber 13. However, the location of a connection 16 is not limited to this. A coil spring 17, a valve 18, packing 19, and the plate member 20 are formed in the connection 16. In the usual condition, since the valve 18 has stuck to packing 19 by the spring force of a coil spring 17, the chamber 13 is sealed to the exterior of an ink cartridge 11. Therefore, in this condition, ink does not leak to the exterior of an ink cartridge 11 through a connection 16. The plate member 20 is used for fixing packing 19 to a connection 16.

[0032] The electrodes 21a and 21b of a pair are formed in the right-hand side of a chamber 13. Electrodes 21a and 21b are advancing into a chamber 13, and, on the other hand, are projected to the exterior of an ink cartridge 11. A pulse voltage is impressed to Electrodes 21a and 21b, and the residue of the ink in a chamber 13 can be detected to them by detecting the potential difference between electrode 21a and 21b by the well-known approach.

[0033] Since the ink currently held at sponge 14 will not necessarily be temporarily consumed by homogeneity supposing Electrodes 21a and 21b were formed in the chamber 12, it is difficult to

detect the residue of ink correctly. That is, if Electrodes 21a and 21b are formed in the chamber 12, since a lot of ink is ***ing to some sponge 14, big variation will arise in the ink piece in a detection part. Therefore, when the worst, in spite of being detected as there being still residues of enough of ink, during printing, an ink piece is generated suddenly and poor printing may be caused.

[0034] However, in this example, Electrodes 21a and 21b are formed not in the chamber 12 but in the chamber 13. That is, since detection of the residue of ink is performed in the liquid with which it is not prepared in porous bodies, such as ink, i.e., sponge etc., the residue of ink is correctly detectable. Therefore, in this example, the residue of ink can always be detected correctly, without producing un-arranging [that an ink piece is undetectable], in spite of detecting an ink piece or having generated the ink piece accidentally.

[0035] Drawing 3 is the circuit diagram showing an example of the circuit which detects the residue of the ink in a chamber 13. Among this drawing, it connects with the supply voltage of +5V through resistance 22, and, on the other hand, the node N1 is connected to above-mentioned electrode 21a and the residue detecting circuit 23. A node N2 is grounded and, on the other hand, is connected to above-mentioned electrode 21b and the residue detecting circuit 23. Since the resistance between electrode 21a and 21b changes according to the residue of the ink in a chamber 13, the residue detecting circuit 23 can detect the residue of the ink in a chamber 13 by detecting the potential difference between nodes N [N1 and] 2. In addition, since such residue detecting circuit 23 the very thing is well-known, illustration and explanation of the internal configuration are omitted.

[0036] Next, the actuation in the case of equipping a print head 1 with an ink cartridge 11 is explained with drawing 4 and drawing 5 . Drawing 4 is the side elevation showing the condition that the tip of the delivery pipe 2 of a print head 1 contacts the connection 16 of an ink cartridge 11, and the cross section has shown the part of an ink cartridge 11. Drawing 5 is the side elevation showing the condition that the print head 1 was completely equipped with the ink cartridge 11, and a cross section shows the part of an ink cartridge 11.

[0037] In the state of drawing 4 , the valve 18 was pushed by the tip of a delivery pipe 2, and is distorted, and the clearance between a valve 18 and the tip of a delivery pipe 2 is lost. Moreover, since the configuration of packing 19 is equivalent to the configuration at the tip of a delivery pipe 2, air is not left near a valve 18 and a delivery pipe 2, and air bubbles do not invade in the chamber 13 of an ink cartridge 22. In this example, the taper configuration at the tip of a delivery pipe 2 is equivalent to the taper configuration in opening of the lower part of packing 19, and while the lower part of a valve 18 and the upper part of packing 19 are convex respectively, they serve as a spherical-surface configuration of concave in the shape of a globular form, and a top.

[0038] In addition, the configuration at the tip of a delivery pipe 2, the configuration of a valve 18, and the configuration of packing 19 are not limited to what is shown in drawing 4 , respectively. Moreover, although a valve 18 and packing 19 consist of an ingredient which has flexibility in this example, if invasion into the chamber 13 of air bubbles can be prevented, it is not necessary to necessarily use the ingredient which has flexibility. What is necessary is in short, for a delivery pipe 2 to be in the condition of being in contact with the connection 16 of an ink cartridge 11, and just to use a configuration and the quality of the material by which air is not left near a valve 18 and a delivery pipe 2.

[0039] However, in this example, a valve 18 and packing 19 consist of ethylene propylene rubber whose degree of hardness is 40 - 70 degrees preferably as a desirable gestalt, respectively. In drawing 4 , if an ink cartridge 11 is further inserted in the direction of arrow-head A to a print

head 1, it will be in the **** condition shown in drawing 5. In this condition, the valve 18 is made the method of drawing Nakagami against the coil spring 17 with the delivery pipe 2, and carries out opening of the hole 2a prepared at the tip of a delivery pipe 2 within a chamber 13. Therefore, the ink in a chamber 13 is supplied to a print head 1 through hole 2a. In addition, one hole 2a of a delivery pipe 2 may be prepared, or may be prepared, and the magnitude, configuration, and location of hole 2a are not limited to the thing of this example. [two or more] What is necessary is in short, to be in the condition with which the print head 1 was equipped completely, as an ink cartridge 11 shows drawing 5, and just to set the magnitude, configuration, and location of hole 2a as arbitration according to the ink used that the ink in a chamber 13 should just be supplied to a print head 1 good through hole 2a of a delivery pipe 2.

[0040] An ink cartridge 11 can be removed from a print head 1 by performing actuation contrary to the above. Where [usual] an ink cartridge 11 is removed from a print head 1, since the valve 18 has stuck to packing 19 by the spring force of a coil spring 17, the chamber 13 is sealed to the exterior of an ink cartridge 11. Therefore, in this condition, ink does not leak to the exterior of an ink cartridge 11 through a connection 16.

[0041] Next, the 1st example of the ink jet printer which becomes this invention is explained with drawing 6 and drawing 7. Drawing 6 is the perspective view showing the important section of the 1st example of an ink jet printer, and drawing 7 is the perspective view showing the head section. In the 1st example of an ink jet printer, the 1st example of an ink cartridge and the 2nd example of a print head are used.

[0042] An ink jet printer 40 consists of the profile frame 41, a carrier 42, the stage shaft 43, the paper feed roller 44, the head section 45, the backup unit 46, a motor 47, and belt 48 grade in drawing 6. A carrier 42 is minded with a belt 48, is driven by the motor 47, is guided at the stage shaft 43, and is movable to the direction of X in the said drawing. The head section 45 is attached in this carrier 42. Paper 50 is sent with the paper feed roller 44, and the head section 45 prints an image on paper 50 based on the image data which received for example, from high order equipment (not shown).

[0043] The backup unit 46 is formed as a protection feature of the head section 45. In order to prevent a dot omission, it attracts ink and air bubbles from the nozzle of the head section 45, and makes it discharge, if the backup unit 46 has the head section 45 in the position in readiness of the left-hand side in drawing 6 and predetermined actuation performs it by the user.

[0044] Since a respectively well-known configuration can be used for the parts of the above-mentioned frame 41, a carrier 42, the stage shaft 43, the paper feed roller 44, the backup unit 46, a motor 47, and the ink jet printer 40 that consists of belt 48 grade, such structures and detailed explanation of operation are omitted.

[0045] By this example, the description is in the configuration of the head section 45, and the configuration of the head section 45 is explained with drawing 7. Drawing 7 R> 7 is shown where covering is removed for the head section 45. In drawing 7, the head section 45 has housing 51 and two or more release levers 5-1 to 5-5 are formed in housing 51. Moreover, the slot 52 is formed in the location corresponding to the release lever 5-1 to 5-5 of housing 51, respectively. The ink cartridge 11-1 to 11-5 is mountable/dismountable to the print head (not shown) which is inserted in the corresponding slot 52 and corresponds by actuation of a release lever 5-1 to 5-5, respectively. At drawing 7, the front stirrup by which only an ink cartridge 5-1 is completely inserted in a slot 52 is shown in the condition of being sampled from a slot 52. Although it is made to correspond to five ink cartridges 11-1 to 11-5 and five print heads are prepared in the lower part of housing 51 in this example, it is not visible in drawing 7. Each ink

cartridge 11-1 to 11-5 and each print head have the same configuration as drawing 1, drawing 2, drawing 4, and drawing 5 fundamentally. Therefore, the 2nd example of a print head has substantially two or more things of the same configuration as the 1st example of a print head.

[0046] In addition, inside the head section 45, passage is divided about the ink of each color, and only the part of a delivery pipe becomes exterior plurality, and a head is divided roughly and consists only of two nozzle parts, the object for monochrome, and the object for colors. In this example, the ink cartridge 11-1 to 11-4 has stored the ink of the black used at the time of color printing, respectively, yellow, a Magenta, and cyanogen, for example. Moreover, an ink cartridge 5-5 is somewhat larger than other ink cartridges 11-1 to 11-4, and has stored the black ink used at the time of monochrome printing. Therefore, at this example, the ink of different black is supplied from a separate ink cartridge in the time of color printing and monochrome printing. By considering as such a configuration, it becomes possible to use the print head of different structure for the print head corresponding to an ink cartridge 11-1 to 11-4, and the print head corresponding to an ink cartridge 5-5.

[0047] Since color mixture will specifically be carried out in the paper if dryness of ink is late in order to use multiple color in color printing, the ink of many [the amount of solvent] osmosis mold is used as an object for assignment papers. On the other hand, in monochrome printing, since regular papers, such as PPC, are generally used, in order to print finely on such paper, the ink of an evaporation mold with which it is watery and alcohol was added in which ink does not bleed on paper is used.

[0048] In addition, things cannot be overemphasized that an ink cartridge and the corresponding number of print heads should just be one or more, respectively. Next, the 2nd example of an ink cartridge which becomes this invention is explained with drawing 8 -10. Drawing 8 is the sectional view showing the 2nd example of an ink cartridge with the 3rd example of a print head which becomes this invention. Moreover, drawing 9 R>9 and drawing 10 are sectional views which explain actuation of the 2nd example of an ink cartridge, and the 3rd example of a print head, respectively, and illustration of a connection 16 and the upper part of an ink cartridge 61 is omitted. The same sign is given to the same part as drawing 1, drawing 2 R>2, drawing 4, and drawing 5 among drawing 8 - drawing 10, and the explanation is omitted.

[0049] In this example, as shown in drawing 8, a part of lower part of the chamber 12 of an ink cartridge 61 has entered into the chamber 13, and the chamber 12 and the chamber 13 are open for free passage through the passage 63 which is open for free passage to the free passage hole 15. Passage 63 has structure which does not bar the flow of ink, and the end is turning [passage] opening upward to the chamber 12, and it is turning opening of the other end through the free passage hole 15 upward to the chamber 13. The filter member 64 is formed in the free passage hole 15.

[0050] The filter member 64 consists of stainless steel with which water repellence has a mesh by #30-#800. Moreover, the chamber 13 is set as volume from which the volume of the ink held in a chamber 13 by the meniscus force of the filter member 64 after air bubbles' contacting at Electrodes 21a and 21b is set to about 0.05 cc at least.

[0051] Within the chamber 12 of an ink cartridge 61, as an arrow head shows to drawing 9, with sponge 14, negative pressure is generated and ink is held. However, if the residue of the ink in sponge 14 decreases with consumption of ink, as an arrow head shows to drawing 10, air bubbles will mix into passage 63 and sponge 14, and the negative pressure by sponge 14 will disappear. Consequently, maintenance of the ink by sponge 14 becomes impossible.

[0052] On the other hand, the meniscus force is formed of the filter member 64 at the same time

the negative pressure by sponge 14 disappears. The ink in a chamber 13 is held with the negative pressure generated according to this meniscus force. If ink is consumed further, the meniscus force by the filter member 64 will also be extinguished, and air bubbles will mix also in a chamber 13. However, since the meniscus force is again formed immediately after air bubbles secede from the filter member 64, before the ink side in a chamber 13 becomes lower than the filter member 64, it is possible to hold ink with negative pressure continuously.

[0053] If the residue of ink decreases remarkably, air bubbles will pile up above a chamber 13, electrode 21a will be contacted, and resistance between electrode 21a and 21b will change.

Therefore, the residue of ink is correctly detectable if change of this resistance is detected in the residue detecting circuit like drawing 3.

[0054] In the usual condition that a print head 1 is not equipped with the ink cartridge 61, the valve 18 shown in drawing 8 is pressed against O ring 66 with the coil spring 17, and ink has prevented leaking to the exterior of an ink cartridge 61. On the other hand, if a print head 1 is equipped with an ink cartridge 61, the delivery pipe 2 of a print head 1 will push up a valve 18 against the spring force of a coil spring 17, and the passage of ink will be formed between a chamber 13 and a print head 1 through hole 2a of a delivery pipe 2. Thereby, the ink supplied from an ink cartridge 61 is pressurized by the regurgitation energy generation component 68 of a print head 1, serves as an ink droplet from a nozzle 3, and is breathed out by record media, such as paper (not shown). O ring 66 consists of the same ingredient as a valve 18, and the regurgitation energy generation component 68 consists of a piezo-electric element etc.

[0055] If the negative pressure by the sponge 14 in a chamber 12 disappears and air mixes in a chamber 13 by this example like the above, the mini SUKASU force will be formed of the filter member 64. Thus, the mesh filter of #30-#800 is used for a mesh as a filter member 64 so that the meniscus force formed can generate negative pressure equivalent to sponge 14. Moreover, that from which a contact angle with ink becomes about 5 times or more is used for the quality of the material of the filter member 64 so that balking of air bubbles may be performed easily.

[0056] When the meniscus force of the filter member 64 and the pressure in a chamber 13 balance, the ink in a chamber 13 is held. However, if the pressure in a chamber 13 declines with consumption of ink, the meniscus force of the filter member 64 will be extinguished and air bubbles will mix in a chamber 13. It is [***** / immediately after air bubbles secede from the filter member 64, before the meniscus force is again formed of the filter member 64 and the ink side in a chamber 13 becomes lower than the filter member 64] possible to hold ink with negative pressure continuously. Since the end of passage 63 is turning opening upward to the chamber 12, air bubbles secede from the filter member 64, before growing up to be big air bubbles by the buoyancy. For this reason, the pressure fluctuation in the chamber 13 accompanying balking from the filter member 64 of air bubbles can be controlled to the minimum.

[0057] The air bubbles which entered in the chamber 13 contact electrode 21a arranged in the upper part of a chamber 13, and the residue of ink is detected by the *** residue detecting circuit immediately shown in drawing 3. In this example, when it is detected that there is no residue of ink, the ink of sufficient amount to perform at least 1-page printing in a chamber 13 is secured. Therefore, immediately after detecting that there is no residue of ink, ink is held with negative pressure by the filter member 64, and ink does not go out suddenly during printing.

[0058] Next, the count approach of the amount of ink required at one print head 1 to perform at least 1-page printing is explained. The amount of ink required at the time of printing of a text for convenience of explanation shall be calculated. In the ink injection quantity per nozzle 3, if the

rate of printing of A4=11x8 inch and an assumption printing pattern considers as 5%, as for the number of dots per page, it will become $x(11 \times 360)(8 \times 360) = 11,404,800$ dot, and as for the amount of use ink per page, the size of 360dpi and a record medium (paper) is set [resolution / of 50pl(s) and an ink jet printer] to $50\text{pl}/\text{dot} \times 11,404,800 \text{ dot} \times 0.05 = 0.028\text{cc}$.

[0059] Therefore, as for the amount of ink held by the meniscus force of the filter member 64 in the above-mentioned example, it is desirable to secure 0.05 cc or more which expected the twice [about] as many margin as this. Next, the 4th example of a print head which becomes this invention is explained with drawing 11. Drawing 11 is the perspective view showing the 4th example of a print head with the 3rd example of an ink cartridge which becomes this invention. The same sign is given to the same part as drawing 8 among this drawing, and the explanation is omitted.

[0060] In this example, the head section 75 uses four ink cartridges 61-1 to 61-4. Since these ink cartridges 61-1 to 61-4 have stored the ink of black, yellow, a Magenta, and cyanogen, respectively, they can be color-printed by this example. Each ink cartridge 61-1 to 61-4 has the atmospheric pressure release hole 69 in the upper part, and has a part for the height 70 of a pair in the lower part. The part of others of each ink cartridge 61-1 to 61-4 has the same structure as fundamentally as the above-mentioned ink cartridge 61.

[0061] On the other hand, four print heads 1 are formed in the head section 75, it is made to correspond to the stowed position of each ink cartridge 61-1 to 61-4, and four pairs of slots 72 are formed. In case the print head 1 to which each ink cartridge 61-1 to 61-4 corresponds is equipped, it fits into a height part 70 fang-furrow part, and positioning is made. Wearing of an ink cartridge is inserted from a top so that a delivery pipe 2 may enter in a connection 16 (not shown) first, and after it inserts a part for one height 70 in a part for the corresponding slot 72, it is inserted in a part for the slot 72 of another side which moves an ink cartridge for a while along the migration direction X of the head section 75, and corresponds a part for the height 70 of another side.

[0062] In addition, in the **** configuration shown drawing 6, the head section 75 shown in drawing 11 instead of the head section 45 is used for the 2nd example of the ink jet printer which becomes this invention. Moreover, it cannot be overemphasized that it is also possible to combine each above-mentioned example with arbitration. Furthermore, the number of the electrodes for detecting the residue of ink is not limited to two, and may prepare two or more electrodes. Like each above-mentioned example, the number of the chambers in an ink cartridge is not limited to two, either, but may prepare two or more chambers.

[0063] As mentioned above, although the example explained this invention, this invention is not limited to these examples and it cannot be overemphasized that deformation and amelioration various by within the limits of this invention are possible.

[0064]

[Effect of the Invention] Since it can prevent certainly that ink leaks to the exterior of an ink cartridge also in case an ink cartridge is removed from a print head while air bubbles can prevent certainly invading into an ink cartridge or a print head according to invention according to claim 1, in case a print head is equipped with an ink cartridge, it becomes possible to improve the dependability of an ink jet printer.

[0065] According to invention according to claim 2, in case a print head is equipped with an ink cartridge, air bubbles can prevent especially invading into an ink cartridge or a print head certainly. According to invention according to claim 3, with an easy configuration, in case a print head is equipped with an ink cartridge, it can prevent certainly that air bubbles invade into an ink

cartridge or a print head.

[0066] According to invention according to claim 4, in case a print head is equipped with an ink cartridge, air bubbles can prevent especially invading into an ink cartridge or a print head certainly. According to invention according to claim 5, it can prevent certainly that a clearance occurs in the condition that a delivery pipe contacts a valve means.

[0067] According to invention according to claim 6, the residue of ink is correctly detectable with high dependability. According to invention according to claim 7, even if the residue of ink decreases, ink can be held with negative pressure.

[0068] According to invention according to claim 8, with an easy configuration, even when there are few residues of ink, ink can be held with negative pressure. According to invention according to claim 9, with an easy configuration, even when there are few residues of ink, ink can be held with negative pressure.

[0069] According to invention according to claim 10, with an easy configuration, even when there are few residues of ink, ink can be held with negative pressure. According to invention according to claim 11, the residue of ink can be correctly detected with high dependability, and the variation in the actual ink residue in the condition of having detected the ink piece can also be abolished.

[0070] Since according to invention according to claim 12 at least 1 page can be completely printed after an ink piece is detected, the situation whose ink is suddenly lost during printing is avoidable. Since according to invention according to claim 13 it can prevent certainly that ink leaks to the exterior of an ink cartridge also in case a dot omission does not arise and an ink cartridge is removed from a print head with an easy configuration, since air bubbles can prevent certainly invading into an ink cartridge or a print head in case a print head is equipped with an ink cartridge, it becomes possible to improve the dependability of an ink jet printer.

[0071] Since according to invention according to claim 14 it can prevent certainly that ink leaks to the exterior of an ink cartridge also in case a dot omission does not arise and an ink cartridge is removed from a print head with an easy configuration, since air bubbles can prevent certainly invading into an ink cartridge or a print head in case a print head is equipped with an ink cartridge, it becomes possible to improve the dependability of an ink jet printer.

[0072] Therefore, since air bubbles can prevent certainly invading into an ink cartridge or a print head in case a print head is equipped with an ink cartridge according to this invention, also in case a dot omission is not produced but an ink cartridge is removed from a print head, since it can prevent certainly, useless consumption of ink is also avoided, and it also becomes possible [improving the dependability and the running cost of an ink jet printer] for ink to leak to the exterior of an ink cartridge.

TECHNICAL FIELD

[Industrial Application] This invention relates to an ink card ridge, a print head, and an ink jet printer, especially relates to the print head and ink jet printer using the ink cartridge in which desorption is possible, and such an ink cartridge to the print head of an ink jet printer.

PRIOR ART

[Description of the Prior Art] In an ink jet printer, if ink goes out, printing becomes impossible almost momentarily and the so-called dot omission will be started. Then, the residue of ink is always detected, and while suspending printing actuation of an ink jet printer before a dot omission occurs, it is necessary to generate the alarm which demands a supplement of ink from a user. In addition, as the detection approach of the residue of ink, the electrode of a pair is prepared in the ink tank which stores ink, a pulse voltage is impressed so that electrolysis may not be caused between two electrodes, and there is the approach of detecting the residue of ink under supervising resistance change.

[0003] A supplement of ink has troublesome actuation and it is desirable to use the method which exchanges the ink cartridge itself which will contain ink if the above-mentioned alarm is generated also from the field of the running cost of an ink jet printer. The thing of various configurations is proposed as such an ink cartridge.

[0004] Drawing 12 is the side elevation showing an example of the conventional ink cartridge with a print head, and only the ink cartridge in the said drawing is shown by the cross section which removed a part for the upper part. In drawing 12, a print head 501 has the ink needle 503. On the other hand, an ink cartridge 502 has the sponge 506 for generating negative pressure to an elastic member 504, ink 505, and ink 505. It is equipped with an ink cartridge 502 to a print head 501 so that an elastic member 504 may shoot through with the ink needle 503 of a print head 501, and it has structure removed from a print head 501 by actuation contrary to this.

[0005] In anticipated use, an ink cartridge 502 is removed, only when ink goes out and it is exchanged for a new ink cartridge. However, it may mistake, if an ink cartridge 502 is exchanged or ink has run out accidentally by a certain reason, in order to use the ink of a color in which users differ, and an ink cartridge 502 may be removed. Moreover, in case a user performs maintenance, such as cleaning of the print head 501 circumference of an ink jet printer, by himself, also when removing an ink cartridge 502, it thinks.

[0006] When the ink in an ink cartridge 502 removes an ink cartridge 502 from a print head 501 in the condition of having not run out yet, it will be used again, equipping a print head 501 with this same ink cartridge 502. However, after removing an ink cartridge 502 from a print head 501 once, when equipping a print head 501 again, after the path of the ink between a print head 501 and an ink cartridge 502 is severed once, it will be open for free passage again. For this reason, in case the ink needle 503 penetrates an elastic member 504 again, invasion of the air bubbles from the path of the above-mentioned ink to into into a print head 501 and an ink cartridge 502 is not avoided. Even if it is the air bubbles which invaded in the ink cartridge 502, if it is left, any will invade in a print head 501.

EFFECT OF THE INVENTION

[Effect of the Invention] Since it can prevent certainly that ink leaks to the exterior of an ink cartridge also in case an ink cartridge is removed from a print head while air bubbles can prevent certainly invading into an ink cartridge or a print head according to invention according to claim 1, in case a print head is equipped with an ink cartridge, it becomes possible to improve the dependability of an ink jet printer.

[0065] According to invention according to claim 2, in case a print head is equipped with an ink cartridge, air bubbles can prevent especially invading into an ink cartridge or a print head certainly. According to invention according to claim 3, with an easy configuration, in case a print head is equipped with an ink cartridge, it can prevent certainly that air bubbles invade into an ink cartridge or a print head.

[0066] According to invention according to claim 4, in case a print head is equipped with an ink cartridge, air bubbles can prevent especially invading into an ink cartridge or a print head certainly. According to invention according to claim 5, it can prevent certainly that a clearance occurs in the condition that a delivery pipe contacts a valve means.

[0067] According to invention according to claim 6, the residue of ink is correctly detectable with high dependability. According to invention according to claim 7, even if the residue of ink decreases, ink can be held with negative pressure.

[0068] According to invention according to claim 8, with an easy configuration, even when there are few residues of ink, ink can be held with negative pressure. According to invention according to claim 9, with an easy configuration, even when there are few residues of ink, ink can be held with negative pressure.

[0069] According to invention according to claim 10, with an easy configuration, even when there are few residues of ink, ink can be held with negative pressure. According to invention according to claim 11, the residue of ink can be correctly detected with high dependability, and the variation in the actual ink residue in the condition of having detected the ink piece can also be abolished.

[0070] Since according to invention according to claim 12 at least 1 page can be completely printed after an ink piece is detected, the situation whose ink is suddenly lost during printing is avoidable. Since according to invention according to claim 13 it can prevent certainly that ink leaks to the exterior of an ink cartridge also in case a dot omission does not arise and an ink cartridge is removed from a print head with an easy configuration, since air bubbles can prevent certainly invading into an ink cartridge or a print head in case a print head is equipped with an ink cartridge, it becomes possible to improve the dependability of an ink jet printer.

[0071] Since according to invention according to claim 14 it can prevent certainly that ink leaks to the exterior of an ink cartridge also in case a dot omission does not arise and an ink cartridge is removed from a print head with an easy configuration, since air bubbles can prevent certainly invading into an ink cartridge or a print head in case a print head is equipped with an ink cartridge, it becomes possible to improve the dependability of an ink jet printer.

[0072] Therefore, since air bubbles can prevent certainly invading into an ink cartridge or a print head in case a print head is equipped with an ink cartridge according to this invention, also in case a dot omission is not produced but an ink cartridge is removed from a print head, since it can prevent certainly, useless consumption of ink is also avoided, and it also becomes possible [improving the dependability and the running cost of an ink jet printer] for ink to leak to the exterior of an ink cartridge.

TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention] If air bubbles invade in a print head 501, a dot omission will be started at a certain time. Then, the protection feature of the print head 501 called a backup unit is prepared, in order to prevent a dot omission, a backup unit is used and air bubbles are made to attract and discharge from the nozzle of a print head 501 conventionally. However, since ink excessive with a natural thing will also be discharged together in case air bubbles are made to discharge from a nozzle, whenever it equipped with the ink cartridge 502, using a backup unit had the problem that it was not a best policy in the futility of ink.

[0008] Moreover, when air bubbles invaded in an ink cartridge 502, air bubbles might contact the electrode for detecting the residue of ink, and resistance might change to it. For this reason, in spite of having equipped the print head 501 with a new ink cartridge, there was also a problem that an ink piece might be detected accidentally.

[0009] Furthermore, in case an ink cartridge 502 is removed from a print head 501, to take measures which ink leakage does not produce is desired. Then, in case this invention removes an ink cartridge from a print head, it aims at offering the ink card ridge, print head, and ink jet printer which certainly enable prevention of ink leakage, while they enable reliable printing in the case of the mount/dismount to the print head of an ink cartridge, as air bubbles do not invade in an ink cartridge and a print head.

MEANS

[Means for Solving the Problem] The above-mentioned technical problem is an ink cartridge with which the print head which has the delivery pipe which receives supply of ink according to claim 1 is equipped. Casing which has the 1st chamber and 2nd chamber which are open for free passage through a free passage hole, and store ink, It is prepared in the 2nd chamber and has this delivery pipe and a connectable connection. this -- the porous body for being prepared in the 1st chamber and holding ink with negative pressure -- this -- this connection Usually, it has closed and the ink cartridge which has a valve means to open if this delivery pipe is inserted in this connection, and to open this print head and this 2nd chamber for free passage can attain.

[0011] In invention according to claim 2, the part in contact with said delivery pipe of said valve means has the configuration which a clearance does not produce in the condition that this delivery pipe contacts this valve means in invention of claim 1. In invention according to claim 3, said valve means consists of packing with which the valve which has the shape of a hemihedry globular form of a convex in the wearing direction over the print head of an ink cartridge, and this wearing direction have the spherical-surface configuration of concave in an opposite direction, and a spring which forces this valve in the wearing direction to this packing in claim 1 or invention of 2.

[0012] In invention according to claim 4, said valve means consists of the valve which has the shape of a hemihedry globular form of a convex in the wearing direction over the print head of an ink cartridge, an O ring, and a spring which forces this valve in the wearing direction to this O ring in claim 1 or invention of 2.

[0013] In invention according to claim 5, said valve and said packing, or said O ring consists of a spring material whose degree of hardness is 40 - 70 degrees in claim 3 or invention of 4,

respectively. In invention according to claim 6, among claims 1-5, in order to detect the residue of ink in invention of any 1 term, it had further two or more electrodes prepared in said 2nd chamber.

[0014] At invention according to claim 7, among claims 1-5, in invention of any 1 term, it has further the passage which an end connects with said 1st chamber and the other end connects to said 2nd chamber, and the filter member prepared in the other end of this passage, and this filter member is compensated with the fall of the negative pressure holding power of the ink by said porous body accompanying reduction of the residue of ink according to the meniscus force.

[0015] In invention according to claim 8, in invention of claim 7, opening is carried out in the predetermined direction opposite to the wearing direction over the print head of an ink cartridge, and it connects with said 1st chamber, and the other end carries out opening of the end of said passage in this predetermined direction, and connects it to said 2nd chamber.

[0016] In invention according to claim 9, as for said filter member, a mesh consists of an ingredient of #30-#800 in claim 7 or invention of 8. In invention according to claim 10, as for said filter member, a contact angle with ink consists of an ingredient of 5 times or more in invention of any 1 term among claims 7-9.

[0017] In invention according to claim 11, among claims 7-10, in order to detect the residue of ink in invention of any 1 term, it had further two or more electrodes prepared in said 2nd chamber. by invention according to claim 12, the ink of sufficient amount to perform at least 1-page printing in said 2nd chamber remains in the condition that said electrode detects an ink piece, in invention of claim 11 -- as -- this -- it is arranged in the predetermined location in the 2nd chamber.

[0018] Casing which has the chamber in which the above-mentioned technical problem stores ink according to claim 13, It is the print head of the ink jet printer with which it is equipped with the ink cartridge which has the connection which it was prepared in this chamber and has usually been closed. The delivery pipe which is inserted in these connection circles of this ink cartridge, and receives supply of ink, It has a nozzle and the regurgitation energy generation component which carries out the regurgitation of the ink supplied from this delivery pipe through this nozzle. This delivery pipe The print head which has the point of the configuration which does not produce a clearance where this connection is contacted, and 1 or two or more holes which carry out opening into this chamber in the condition of it having been prepared in this point and having been inserted in these connection circles can also attain.

[0019] Casing which has the chamber which is mountable/dismountable to a print head according to claim 14 as for the above-mentioned technical problem, and stores ink, It is an ink jet printer using the ink cartridge which has the connection which it was prepared in this chamber and has usually been closed. A carrier, It has the head section which it is attached in this carrier and driven with this carrier. This head section It consists of 1 or two or more print heads. Each print head The delivery pipe which is inserted in these connection circles of this ink cartridge, and receives supply of ink, It has a nozzle and the regurgitation energy generation component which carries out the regurgitation of the ink supplied from this delivery pipe through this nozzle. This delivery pipe The ink jet printer which has the point of the configuration which does not produce a clearance where this connection is contacted, and 1 or two or more holes which carry out opening into this chamber in the condition of it having been prepared in this point and having been inserted in these connection circles can also attain.

OPERATION

[Function] Since it can prevent certainly that ink leaks to the exterior of an ink cartridge also in case an ink cartridge is removed from a print head while air bubbles can prevent certainly invading into an ink cartridge or a print head according to invention according to claim 1, in case a print head is equipped with an ink cartridge, it becomes possible to improve the dependability of an ink jet printer.

[0021] According to invention according to claim 2, in case a print head is equipped with an ink cartridge, air bubbles can prevent especially invading into an ink cartridge or a print head certainly. According to invention according to claim 3, with an easy configuration, in case a print head is equipped with an ink cartridge, it can prevent certainly that air bubbles invade into an ink cartridge or a print head.

[0022] According to invention according to claim 4, in case a print head is equipped with an ink cartridge, air bubbles can prevent especially invading into an ink cartridge or a print head certainly. According to invention according to claim 5, it can prevent certainly that a clearance occurs in the condition that a delivery pipe contacts a valve means.

[0023] According to invention according to claim 6, the residue of ink is correctly detectable with high dependability. According to invention according to claim 7, even if the residue of ink decreases, ink can be held with negative pressure.

[0024] According to invention according to claim 8, with an easy configuration, even when there are few residues of ink, ink can be held with negative pressure. According to invention according to claim 9, with an easy configuration, even when there are few residues of ink, ink can be held with negative pressure.

[0025] According to invention according to claim 10, with an easy configuration, even when there are few residues of ink, ink can be held with negative pressure. According to invention according to claim 11, the residue of ink can be correctly detected with high dependability, and the variation in the actual ink residue in the condition of having detected the ink piece can also be abolished.

[0026] Since according to invention according to claim 12 at least 1 page can be completely printed after an ink piece is detected, the situation whose ink is suddenly lost during printing is avoidable. Since according to invention according to claim 13 it can prevent certainly that ink leaks to the exterior of an ink cartridge also in case a dot omission does not arise and an ink cartridge is removed from a print head with an easy configuration, since air bubbles can prevent certainly invading into an ink cartridge or a print head in case a print head is equipped with an ink cartridge, it becomes possible to improve the dependability of an ink jet printer.

[0027] Since according to invention according to claim 14 it can prevent certainly that ink leaks to the exterior of an ink cartridge also in case a dot omission does not arise and an ink cartridge is removed from a print head with an easy configuration, since air bubbles can prevent certainly invading into an ink cartridge or a print head in case a print head is equipped with an ink cartridge, it becomes possible to improve the dependability of an ink jet printer.

[0028] Therefore, since air bubbles can prevent certainly invading into an ink cartridge or a print head in case a print head is equipped with an ink cartridge according to this invention, also in case a dot omission is not produced but an ink cartridge is removed from a print head, since it can prevent certainly, useless consumption of ink is also avoided, and it also becomes possible [improving the dependability and the running cost of an ink jet printer] for ink to leak to the exterior of an ink cartridge.

EXAMPLE

[Example] Drawing 1 is the side elevation showing the 1st example of an ink cartridge which becomes this invention with the 1st example of a print head which becomes this invention. In drawing 1, a print head 1 has the delivery pipe 2 and nozzle 3 for supplying ink. The ink cartridge 11 is mountable/dismountable to a print head 1 by actuation of a release lever 5. In addition, although illustration is omitted in drawing 1, in case mount/dismount of the ink cartridge 11 is carried out to a print head 1, it cannot be overemphasized that the guidance device in which an ink cartridge 11 is guided may be established.

[0030] Drawing 2 is the sectional view showing the important section of an ink cartridge 11. A chamber 12 is formed in the upper part of casing of an ink cartridge 11 among this drawing, and the chamber 13 is formed in the lower part of casing. In the chamber 12, the sponge 14 holding the ink in an ink cartridge 11 is contained. Of course, a suitable porous body may be used instead of sponge 14. A chamber 13 holds temporarily the ink supplied to a print head 1. These chambers 12 and 13 are open for free passage through the free passage hole 15.

[0031] In this example, the connection 16 linked to the delivery pipe 2 of a print head 1 is formed in the left-hand side of a chamber 13. However, the location of a connection 16 is not limited to this. A coil spring 17, a valve 18, packing 19, and the plate member 20 are formed in the connection 16. In the usual condition, since the valve 18 has stuck to packing 19 by the spring force of a coil spring 17, the chamber 13 is sealed to the exterior of an ink cartridge 11. Therefore, in this condition, ink does not leak to the exterior of an ink cartridge 11 through a connection 16. The plate member 20 is used for fixing packing 19 to a connection 16.

[0032] The electrodes 21a and 21b of a pair are formed in the right-hand side of a chamber 13. Electrodes 21a and 21b are advancing into a chamber 13, and, on the other hand, are projected to the exterior of an ink cartridge 11. A pulse voltage is impressed to Electrodes 21a and 21b, and the residue of the ink in a chamber 13 can be detected to them by detecting the potential difference between electrode 21a and 21b by the well-known approach.

[0033] Since the ink currently held at sponge 14 will not necessarily be temporarily consumed by homogeneity supposing Electrodes 21a and 21b were formed in the chamber 12, it is difficult to detect the residue of ink correctly. That is, if Electrodes 21a and 21b are formed in the chamber 12, since a lot of ink is ***ing to some sponge 14, big variation will arise in the ink piece in a detection part. Therefore, when the worst, in spite of being detected as there being still residues of enough of ink, during printing, an ink piece is generated suddenly and poor printing may be caused.

[0034] However, in this example, Electrodes 21a and 21b are formed not in the chamber 12 but in the chamber 13. That is, since detection of the residue of ink is performed in the liquid with which it is not prepared in porous bodies, such as ink, i.e., sponge etc., the residue of ink is correctly detectable. Therefore, in this example, the residue of ink can always be detected correctly, without producing un-arranging [that an ink piece is undetectable], in spite of detecting an ink piece or having generated the ink piece accidentally.

[0035] Drawing 3 is the circuit diagram showing an example of the circuit which detects the residue of the ink in a chamber 13. Among this drawing, it connects with the supply voltage of +5V through resistance 22, and, on the other hand, the node N1 is connected to above-mentioned electrode 21a and the residue detecting circuit 23. A node N2 is grounded and, on the other hand,

is connected to above-mentioned electrode 21b and the residue detecting circuit 23. Since the resistance between electrode 21a and 21b changes according to the residue of the ink in a chamber 13, the residue detecting circuit 23 can detect the residue of the ink in a chamber 13 by detecting the potential difference between nodes N [N1 and] 2. In addition, since such residue detecting circuit 23 the very thing is well-known, illustration and explanation of the internal configuration are omitted.

[0036] Next, the actuation in the case of equipping a print head 1 with an ink cartridge 11 is explained with drawing 4 and drawing 5. Drawing 4 is the side elevation showing the condition that the tip of the delivery pipe 2 of a print head 1 contacts the connection 16 of an ink cartridge 11, and the cross section has shown the part of an ink cartridge 11. Drawing 5 is the side elevation showing the condition that the print head 1 was completely equipped with the ink cartridge 11, and a cross section shows the part of an ink cartridge 11.

[0037] In the state of drawing 4, the valve 18 was pushed by the tip of a delivery pipe 2, and is distorted, and the clearance between a valve 18 and the tip of a delivery pipe 2 is lost. Moreover, since the configuration of packing 19 is equivalent to the configuration at the tip of a delivery pipe 2, air is not left near a valve 18 and a delivery pipe 2, and air bubbles do not invade in the chamber 13 of an ink cartridge 22. In this example, the taper configuration at the tip of a delivery pipe 2 is equivalent to the taper configuration in opening of the lower part of packing 19, and while the lower part of a valve 18 and the upper part of packing 19 are convex respectively, they serve as a spherical-surface configuration of concave in the shape of a globular form, and a top.

[0038] In addition, the configuration at the tip of a delivery pipe 2, the configuration of a valve 18, and the configuration of packing 19 are not limited to what is shown in drawing 4, respectively. Moreover, although a valve 18 and packing 19 consist of an ingredient which has flexibility in this example, if invasion into the chamber 13 of air bubbles can be prevented, it is not necessary to necessarily use the ingredient which has flexibility. What is necessary is in short, for a delivery pipe 2 to be in the condition of being in contact with the connection 16 of an ink cartridge 11, and just to use a configuration and the quality of the material by which air is not left near a valve 18 and a delivery pipe 2.

[0039] However, in this example, a valve 18 and packing 19 consist of ethylene propylene rubber whose degree of hardness is 40 - 70 degrees preferably as a desirable gestalt, respectively. In drawing 4, if an ink cartridge 11 is further inserted in the direction of arrow-head A to a print head 1, it will be in the **** condition shown in drawing 5. In this condition, the valve 18 is made the method of drawing Nakagami against the coil spring 17 with the delivery pipe 2, and carries out opening of the hole 2a prepared at the tip of a delivery pipe 2 within a chamber 13. Therefore, the ink in a chamber 13 is supplied to a print head 1 through hole 2a. In addition, one hole 2a of a delivery pipe 2 may be prepared, or may be prepared, and the magnitude, configuration, and location of hole 2a are not limited to the thing of this example. [two or more] What is necessary is in short, to be in the condition with which the print head 1 was equipped completely, as an ink cartridge 11 shows drawing 5, and just to set the magnitude, configuration, and location of hole 2a as arbitration according to the ink used that the ink in a chamber 13 should just be supplied to a print head 1 good through hole 2a of a delivery pipe 2.

[0040] An ink cartridge 11 can be removed from a print head 1 by performing actuation contrary to the above. Where [usual] an ink cartridge 11 is removed from a print head 1, since the valve 18 has stuck to packing 19 by the spring force of a coil spring 17, the chamber 13 is sealed to the exterior of an ink cartridge 11. Therefore, in this condition, ink does not leak to the exterior of an ink cartridge 11 through a connection 16.

[0041] Next, the 1st example of the ink jet printer which becomes this invention is explained with drawing 6 and drawing 7. Drawing 6 is the perspective view showing the important section of the 1st example of an ink jet printer, and drawing 7 is the perspective view showing the head section. In the 1st example of an ink jet printer, the 1st example of an ink cartridge and the 2nd example of a print head are used.

[0042] An ink jet printer 40 consists of the profile frame 41, a carrier 42, the stage shaft 43, the paper feed roller 44, the head section 45, the backup unit 46, a motor 47, and belt 48 grade in drawing 6. A carrier 42 is minded with a belt 48, is driven by the motor 47, is guided at the stage shaft 43, and is movable to the direction of X in the said drawing. The head section 45 is attached in this carrier 42. Paper 50 is sent with the paper feed roller 44, and the head section 45 prints an image on paper 50 based on the image data which received for example, from high order equipment (not shown).

[0043] The backup unit 46 is formed as a protection feature of the head section 45. In order to prevent a dot omission, it attracts ink and air bubbles from the nozzle of the head section 45, and makes it discharge, if the backup unit 46 has the head section 45 in the position in readiness of the left-hand side in drawing 6 and predetermined actuation performs it by the user.

[0044] Since a respectively well-known configuration can be used for the parts of the above-mentioned frame 41, a carrier 42, the stage shaft 43, the paper feed roller 44, the backup unit 46, a motor 47, and the ink jet printer 40 that consists of belt 48 grade, such structures and detailed explanation of operation are omitted.

[0045] By this example, the description is in the configuration of the head section 45, and the configuration of the head section 45 is explained with drawing 7. Drawing 7 R>7 is shown where covering is removed for the head section 45. In drawing 7, the head section 45 has housing 51 and two or more release levers 5-1 to 5-5 are formed in housing 51. Moreover, the slot 52 is formed in the location corresponding to the release lever 5-1 to 5-5 of housing 51, respectively. The ink cartridge 11-1 to 11-5 is mountable/dismountable to the print head (not shown) which is inserted in the corresponding slot 52 and corresponds by actuation of a release lever 5-1 to 5-5, respectively. At drawing 7, the front stirrup by which only an ink cartridge 5-1 is completely inserted in a slot 52 is shown in the condition of being sampled from a slot 52. Although it is made to correspond to five ink cartridges 11-1 to 11-5 and five print heads are prepared in the lower part of housing 51 in this example, it is not visible in drawing 7. Each ink cartridge 11-1 to 11-5 and each print head have the same configuration as drawing 1, drawing 2, drawing 4, and drawing 5 fundamentally. Therefore, the 2nd example of a print head has substantially two or more things of the same configuration as the 1st example of a print head.

[0046] In addition, inside the head section 45, passage is divided about the ink of each color, and only the part of a delivery pipe becomes exterior plurality, and a head is divided roughly and consists only of two nozzle parts, the object for monochrome, and the object for colors. In this example, the ink cartridge 11-1 to 11-4 has stored the ink of the black used at the time of color printing, respectively, yellow, a Magenta, and cyanogen, for example. Moreover, an ink cartridge 5-5 is somewhat larger than other ink cartridges 11-1 to 11-4, and has stored the black ink used at the time of monochrome printing. Therefore, at this example, the ink of different black is supplied from a separate ink cartridge in the time of color printing and monochrome printing. By considering as such a configuration, it becomes possible to use the print head of different structure for the print head corresponding to an ink cartridge 11-1 to 11-4, and the print head corresponding to an ink cartridge 5-5.

[0047] Since color mixture will specifically be carried out in the paper if dryness of ink is late in

order to use multiple color in color printing, the ink of many [the amount of solvent] osmosis mold is used as an object for assignment papers. On the other hand, in monochrome printing, since regular papers, such as PPC, are generally used, in order to print finely on such paper, the ink of an evaporation mold with which it is watery and alcohol was added in which ink does not bleed on paper is used.

[0048] In addition, things cannot be overemphasized that an ink cartridge and the corresponding number of print heads should just be one or more, respectively. Next, the 2nd example of an ink cartridge which becomes this invention is explained with drawing 8 -10. Drawing 8 is the sectional view showing the 2nd example of an ink cartridge with the 3rd example of a print head which becomes this invention. Moreover, drawing 9 R> 9 and drawing 10 are sectional views which explain actuation of the 2nd example of an ink cartridge, and the 3rd example of a print head, respectively, and illustration of a connection 16 and the upper part of an ink cartridge 61 is omitted. The same sign is given to the same part as drawing 1 , drawing 2 R> 2 , drawing 4 , and drawing 5 among drawing 8 - drawing 10 , and the explanation is omitted.

[0049] In this example, as shown in drawing 8 , a part of lower part of the chamber 12 of an ink cartridge 61 has entered into the chamber 13, and the chamber 12 and the chamber 13 are open for free passage through the passage 63 which is open for free passage to the free passage hole 15. Passage 63 has structure which does not bar the flow of ink, and the end is turning [passage] opening upward to the chamber 12, and it is turning opening of the other end through the free passage hole 15 upward to the chamber 13. The filter member 64 is formed in the free passage hole 15.

[0050] The filter member 64 consists of stainless steel with which water repellence has a mesh by #30-#800. Moreover, the chamber 13 is set as volume from which the volume of the ink held in a chamber 13 by the meniscus force of the filter member 64 after air bubbles' contacting at Electrodes 21a and 21b is set to about 0.05 cc at least.

[0051] Within the chamber 12 of an ink cartridge 61, as an arrow head shows to drawing 9 , with sponge 14, negative pressure is generated and ink is held. However, if the residue of the ink in sponge 14 decreases with consumption of ink, as an arrow head shows to drawing 10 , air bubbles will mix into passage 63 and sponge 14, and the negative pressure by sponge 14 will disappear. Consequently, maintenance of the ink by sponge 14 becomes impossible.

[0052] On the other hand, the meniscus force is formed of the filter member 64 at the same time the negative pressure by sponge 14 disappears. The ink in a chamber 13 is held with the negative pressure generated according to this meniscus force. If ink is consumed further, the meniscus force by the filter member 64 will also be extinguished, and air bubbles will mix also in a chamber 13. However, since the meniscus force is again formed immediately after air bubbles secede from the filter member 64, before the ink side in a chamber 13 becomes lower than the filter member 64, it is possible to hold ink with negative pressure continuously.

[0053] If the residue of ink decreases remarkably, air bubbles will pile up above a chamber 13, electrode 21a will be contacted, and resistance between electrode 21a and 21b will change. Therefore, the residue of ink is correctly detectable if change of this resistance is detected in the residue detecting circuit like drawing 3 .

[0054] In the usual condition that a print head 1 is not equipped with the ink cartridge 61, the valve 18 shown in drawing 8 is pressed against O ring 66 with the coil spring 17, and ink has prevented leaking to the exterior of an ink cartridge 61. On the other hand, if a print head 1 is equipped with an ink cartridge 61, the delivery pipe 2 of a print head 1 will push up a valve 18 against the spring force of a coil spring 17, and the passage of ink will be formed between a

chamber 13 and a print head 1 through hole 2a of a delivery pipe 2. Thereby, the ink supplied from an ink cartridge 61 is pressurized by the regurgitation energy generation component 68 of a print head 1, serves as an ink droplet from a nozzle 3, and is breathed out by record media, such as paper (not shown). O ring 66 consists of the same ingredient as a valve 18, and the regurgitation energy generation component 68 consists of a piezo-electric element etc.

[0055] If the negative pressure by the sponge 14 in a chamber 12 disappears and air mixes in a chamber 13 by this example like the above, the mini SUKASU force will be formed of the filter member 64. Thus, the mesh filter of #30-#800 is used for a mesh as a filter member 64 so that the meniscus force formed can generate negative pressure equivalent to sponge 14. Moreover, that from which a contact angle with ink becomes about 5 times or more is used for the quality of the material of the filter member 64 so that balking of air bubbles may be performed easily.

[0056] When the meniscus force of the filter member 64 and the pressure in a chamber 13 balance, the ink in a chamber 13 is held. However, if the pressure in a chamber 13 declines with consumption of ink, the meniscus force of the filter member 64 will be extinguished and air bubbles will mix in a chamber 13. It is [***** / immediately after air bubbles secede from the filter member 64, before the meniscus force is again formed of the filter member 64 and the ink side in a chamber 13 becomes lower than the filter member 64] possible to hold ink with negative pressure continuously. Since the end of passage 63 is turning opening upward to the chamber 12, air bubbles secede from the filter member 64, before growing up to be big air bubbles by the buoyancy. For this reason, the pressure fluctuation in the chamber 13 accompanying balking from the filter member 64 of air bubbles can be controlled to the minimum.

[0057] The air bubbles which entered in the chamber 13 contact electrode 21a arranged in the upper part of a chamber 13, and the residue of ink is detected by the *** residue detecting circuit immediately shown in drawing 3. In this example, when it is detected that there is no residue of ink, the ink of sufficient amount to perform at least 1-page printing in a chamber 13 is secured. Therefore, immediately after detecting that there is no residue of ink, ink is held with negative pressure by the filter member 64, and ink does not go out suddenly during printing.

[0058] Next, the count approach of the amount of ink required at one print head 1 to perform at least 1-page printing is explained. The amount of ink required at the time of printing of a text for convenience of explanation shall be calculated. In the ink injection quantity per nozzle 3, if the rate of printing of A4=11x8 inch and an assumption printing pattern considers as 5%, as for the number of dots per page, it will become $x(11 \times 360)(8 \times 360) = 11,404,800$ dot, and as for the amount of use ink per page, the size of 360dpi and a record medium (paper) is set [resolution / of 50pl(s) and an ink jet printer] to $50\text{pl}/\text{dot} \times 11,404,800 \text{ dot} \times 0.05 = 0.028\text{cc}$.

[0059] Therefore, as for the amount of ink held by the meniscus force of the filter member 64 in the above-mentioned example, it is desirable to secure 0.05 cc or more which expected the twice [about] as many margin as this. Next, the 4th example of a print head which becomes this invention is explained with drawing 11. Drawing 11 is the perspective view showing the 4th example of a print head with the 3rd example of an ink cartridge which becomes this invention. The same sign is given to the same part as drawing 8 among this drawing, and the explanation is omitted.

[0060] In this example, the head section 75 uses four ink cartridges 61-1 to 61-4. Since these ink cartridges 61-1 to 61-4 have stored the ink of black, yellow, a Magenta, and cyanogen, respectively, they can be color-printed by this example. Each ink cartridge 61-1 to 61-4 has the atmospheric pressure release hole 69 in the upper part, and has a part for the height 70 of a pair

in the lower part. The part of others of each ink cartridge 61-1 to 61-4 has the same structure as fundamentally as the above-mentioned ink cartridge 61.

[0061] On the other hand, four print heads 1 are formed in the head section 75, it is made to correspond to the stowed position of each ink cartridge 61-1 to 61-4, and four pairs of slots 72 are formed. In case the print head 1 to which each ink cartridge 61-1 to 61-4 corresponds is equipped, it fits into a height part 70 fang-furrow part, and positioning is made. Wearing of an ink cartridge is inserted from a top so that a delivery pipe 2 may enter in a connection 16 (not shown) first, and after it inserts a part for one height 70 in a part for the corresponding slot 72, it is inserted in a part for the slot 72 of another side which moves an ink cartridge for a while along the migration direction X of the head section 75, and corresponds a part for the height 70 of another side.

[0062] In addition, in the **** configuration shown drawing 6, the head section 75 shown in drawing 11 instead of the head section 45 is used for the 2nd example of the ink jet printer which becomes this invention. Moreover, it cannot be overemphasized that it is also possible to combine each above-mentioned example with arbitration. Furthermore, the number of the electrodes for detecting the residue of ink is not limited to two, and may prepare two or more electrodes. Like each above-mentioned example, the number of the chambers in an ink cartridge is not limited to two, either, but may prepare two or more chambers.

[0063] As mentioned above, although the example explained this invention, this invention is not limited to these examples and it cannot be overemphasized that deformation and amelioration various by within the limits of this invention are possible.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

Drawing 1 It is the side elevation showing the 1st example of an ink cartridge with the 1st example of a print head.

Drawing 2 It is the sectional view showing the important section of the 1st example of an ink cartridge.

Drawing 3 It is the circuit diagram showing an example of the circuit which detects the residue of the ink in a chamber.

Drawing 4 The tip of the delivery pipe of a print head is the side elevation showing the condition of contacting the connection of an ink cartridge.

Drawing 5 An ink cartridge is the side elevation showing the condition that the print head 1 was equipped completely.

Drawing 6 It is the perspective view showing the important section of the 1st example of an ink jet printer.

Drawing 7 It is the perspective view showing the head section.

Drawing 8 It is the sectional view showing the 2nd example of an ink cartridge with the 3rd example of a print head.

Drawing 9 It is a sectional view explaining actuation of the 2nd example of an ink cartridge, and the 3rd example of a print head.

Drawing 10 It is a sectional view explaining actuation of the 2nd example of an ink cartridge, and the 3rd example of a print head.

Drawing 11 It is the perspective view showing the 4th example of a print head with the 3rd

example of an ink cartridge.

[Drawing 12] It is the side elevation showing an example of the conventional ink cartridge with a print head.

[Description of Notations]

- 1 Print Head
- 2 Delivery Pipe
- 2a Hole
- 3 Nozzle
- 5 Control Lever
- 11 61 Ink cartridge
- 12 13 Chamber
- 14 Sponge
- 15 Free Passage Hole
- 16 Connection
- 17 Coil Spring
- 18 Valve
- 19 Packing
- 20 Plate Member
- 21a, 21b Electrode
- 23 Residue Detecting Circuit
- 41 Frame
- 42 Carrier
- 43 Stage Shaft
- 44 Paper Feed Roller
- 45 75 Head section
- 46 Backup Unit
- 47 Motor
- 48 Belt
- 50 Paper
- 51 Housing
- 52 Slot
- 63 Passage
- 64 Filter Member
- 66 O Ring
- 68 Regurgitation Energy Generation Component
- 69 Atmospheric Pressure Release Hole
- 70 A Part for Height
- 72 A Part for Slot

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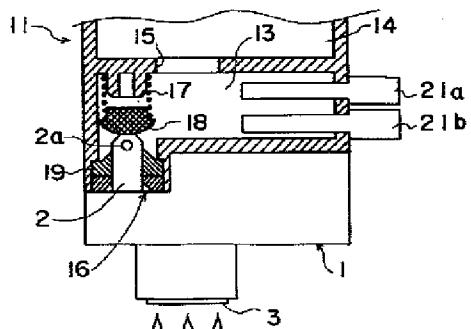
(54)【発明の名称】 インクカートリッジ、プリントヘッド及びインクジェットプリンタ

(57)【要約】

【目的】 インクカートリッジ、プリントヘッド及びインクジェットプリンタに関し、インクカートリッジのプリントヘッドに対する装着脱の際に気泡がインクカートリッジ内及びプリントヘッド内に侵入しないようにして、信頼性の高い印刷を可能とすると共に、インクカートリッジをプリントヘッドから取り外す際にインク漏れを確実に防止可能とすることを目的とする。

【構成】 インクの供給を受ける供給パイプを有するプリントヘッドに装着されるインクカートリッジにおいて、連通孔を介して連通しており、インクを貯蔵する第1のチャンバ及び第2のチャンバを有するケーシングと、前記第1のチャンバ内に設けられ、インクを負圧で保持するための多孔質体と、前記第2のチャンバ内に設けられ、前記供給パイプと接続可能な接続部とを備え、前記接続部は、通常は閉じており、前記供給パイプが前記接続部に挿入されると開いて前記プリントヘッドと前記第2のチャンバとを連通する弁手段を有するように構成する。

インクカートリッジが完全にプリントヘッド1に装着された状態を示す側面図



【特許請求の範囲】

【請求項 1】 インクの供給を受ける供給パイプを有するプリントヘッドに装着されるインクカートリッジであつて、

連通孔を介して連通しており、インクを貯蔵する第 1 のチャンバ及び第 2 のチャンバを有するケーシングと、該第 1 のチャンバ内に設けられ、インクを負圧で保持するための多孔質体と、該第 2 のチャンバ内に設けられ、該供給パイプと接続可能な接続部とを備え、該接続部は、通常は閉じており、該供給パイプが該接続部に挿入されると開いて該プリントヘッドと該第 2 のチャンバとを連通する弁手段を有する、インクカートリッジ。

【請求項 2】 前記弁手段の前記供給パイプと接触する部分は、該供給パイプが該弁手段と当接する状態で隙間が生じない形状を有する、請求項 1 記載のインクカートリッジ。

【請求項 3】 前記弁手段は、インクカートリッジのプリントヘッドに対する装着方向に凸の半面球形状を有する弁と、該装着方向とは反対方向に凹の球面形状を有するパッキンと、該弁を該パッキンに対して装着方向に押し付けるバネとからなる、請求項 1 又は 2 記載のインクカートリッジ。

【請求項 4】 前記弁手段は、インクカートリッジのプリントヘッドに対する装着方向に凸の半面球形状を有する弁と、O リングと、該弁を該 O リングに対して装着方向に押し付けるバネとからなる、請求項 1 又は 2 記載のインクカートリッジ。

【請求項 5】 前記弁及び前記パッキン又は前記 O リングは、夫々硬度が 40 度～70 度の弾性材料からなる、請求項 3 又は 4 記載のインクカートリッジ。

【請求項 6】 インクの残量を検知するために、前記第 2 のチャンバ内に設けられている複数の電極を更に備えた、請求項 1～5 のうちいずれか 1 項記載のインクカートリッジ。

【請求項 7】 一端が前記第 1 のチャンバと接続し、他端が前記第 2 のチャンバに接続する流路と、該流路の他端に設けられたフィルタ部材とを更に備え、該フィルタ部材は、インクの残量の減少に伴う前記多孔質体によるインクの負圧保持力の低下をメニスカス力により補う、請求項 1～5 のうちいずれか 1 項記載のインクカートリッジ。

【請求項 8】 前記流路の一端はインクカートリッジのプリントヘッドに対する装着方向とは反対の所定方向に開口して前記第 1 のチャンバと接続し、他端が該所定方向に開口して前記第 2 のチャンバに接続する、請求項 7 記載のインクカートリッジ。

【請求項 9】 前記フィルタ部材は、メッシュが #30 ～#800 の材料からなる、請求項 7 又は 8 記載のイン

クカートリッジ。

【請求項 10】 前記フィルタ部材は、インクとの接触角が 5 度以上の材料からなる、請求項 7～9 のうちいずれか 1 項記載のインクカートリッジ。

【請求項 11】 インクの残量を検知するために、前記第 2 のチャンバ内に設けられている複数の電極を更に備えた、請求項 7～10 のうちいずれか 1 項記載のインクカートリッジ。

【請求項 12】 前記電極は、インク切れを検知する状態で、前記第 2 のチャンバ内に少なくとも 1 ページの印刷を行うに充分な量のインクが残っているように、該第 2 のチャンバ内の所定位置に配置されている、請求項 11 記載のインクカートリッジ。

【請求項 13】 インクを貯蔵するチャンバを有するケーシングと、該チャンバ内に設けられ通常は閉じている接続部とを有するインクカートリッジが装着されるインクジェットプリンタのプリントヘッドであつて、該インクカートリッジの該接続部内に挿入されインクの供給を受ける供給パイプと、

ノズルと、該供給パイプから供給されたインクを該ノズルを介して吐出する吐出エネルギー発生素子とを備え、該供給パイプは、該接続部に当接した状態で隙間を生じない形状の先端部と、該先端部に設けられ該接続部内に挿入された状態で該チャンバ内に開口する 1 又は複数の孔とを有する、プリントヘッド。

【請求項 14】 プリントヘッドに対して装着脱可能であり、インクを貯蔵するチャンバを有するケーシングと、該チャンバ内に設けられ通常は閉じている接続部とを有するインクカートリッジを用いるインクジェットプリンタであつて、

キャリアと、該キャリアに取り付けられて該キャリアと共に駆動されるヘッド部とを備え、

該ヘッド部は、1 又は複数のプリントヘッドからなり、各プリントヘッドは、該インクカートリッジの該接続部内に挿入されインクの供給を受ける供給パイプと、ノズルと、該供給パイプから供給されたインクを該ノズルを介して吐出する吐出エネルギー発生素子とを備え、該供給パイプは、該接続部に当接した状態で隙間を生じない形状の先端部と、該先端部に設けられ該接続部内に挿入された状態で該チャンバ内に開口する 1 又は複数の孔とを有する、インクジェットプリンタ。

【発明の詳細な説明】

【0001】

【産業上の利用分野】 本発明はインクカートリッジ、プリントヘッド及びインクジェットプリンタに係り、特にインクジェットプリンタのプリントヘッドに対して脱着可能なインクカートリッジ、この様なインクカートリッジを用いるプリントヘッド及びインクジェットプリンタ

に関する。

【0002】

【従来の技術】インクジェットプリンタでは、インクが切れるとほぼ瞬間に印刷ができなくなり、所謂ドット抜けを起こしてしまう。そこで、インクの残量を常に検知して、ドット抜けが発生する前にインクジェットプリンタの印刷動作を停止すると共に、ユーザにインクの補充を促すアラームを発生する必要がある。尚、インクの残量の検知方法としては、インクを貯蔵するインクタンク内に一对の電極を設け、両電極間に電気分解を起こさないようにパルス電圧を印加して、抵抗変化を監視することでインクの残量を検知する方法がある。

【0003】インクの補充は操作が面倒であり、インクジェットプリンタのランニングコストの面からも、上記アラームが発生したらインクを収納するインクカートリッジ自体を交換する方式を用いることが望ましい。この様なインクカートリッジとしては、様々な構成のものが提案されている。

【0004】図12は、従来のインクカートリッジの一例をプリントヘッドと共に示す側面図であり、同図中インクカートリッジのみは上部分を取り除いた断面で示されている。図12において、プリントヘッド501はインク針503を有する。他方、インクカートリッジ502は、弾性部材504、インク505及びインク505に対して負圧を発生するためのスポンジ506を有する。インクカートリッジ502は、弾性部材504がプリントヘッド501のインク針503により貫通されるようにプリントヘッド501に対して装着され、これとは逆の操作によりプリントヘッド501から取り外される構造となっている。

【0005】通常の使用では、インクカートリッジ502は、インクが切れて新しいインクカートリッジと交換される時にのみ取り外される。しかし、ユーザが異なる色のインクを使用するためにインクカートリッジ502を交換したり、何等かの理由で誤ってインクが切れていると勘違いをしてインクカートリッジ502を取り外してしまうこともある。又、ユーザが自分でインクジェットプリンタのプリントヘッド501周辺のクリーニング等のメインテナンスを行う際に、インクカートリッジ502を取り外す場合も考えられる。

【0006】インクカートリッジ502内のインクがまだ切れていない状態でインクカートリッジ502をプリントヘッド501から取り外した場合、再度この同じインクカートリッジ502をプリントヘッド501に装着して使用することになる。しかし、インクカートリッジ502を一度プリントヘッド501から取り外してから再度プリントヘッド501に装着する場合、プリントヘッド501とインクカートリッジ502との間のインクの経路が一度断ち切られてから再度連通されることになる。このため、インク針503が再度弾性部材504を

貫通する際には、上記インクの経路からプリントヘッド501内及びインクカートリッジ502内への気泡の侵入が避けられない。インクカートリッジ502内に侵入した気泡であっても、放置しておけばいずれはプリントヘッド501内に侵入してしまう。

【0007】

【発明が解決しようとする課題】気泡がプリントヘッド501内に侵入すると、ある時点でドット抜けを起こしてしまう。そこで、従来は、バックアップユニットと呼ばれるプリントヘッド501の保護機構が設けられており、ドット抜けを防止するためにバックアップユニットを用いてプリントヘッド501のノズルから気泡を吸引して排出させる。しかし、ノズルから気泡を排出させる際に、当然のことながら余分なインクも一緒に排出されてしまうので、インクカートリッジ502を装着する毎にバックアップユニットを用いるのはインクの無駄で得策ではないという問題があった。

【0008】又、気泡がインクカートリッジ502内に侵入した場合、インクの残量を検知するための電極に気泡が接触し、抵抗が変化してしまうことがあった。このため、プリントヘッド501に新しいインクカートリッジを装着したにも拘らず、誤ってインク切れを検知してしまうこともあるという問題もあった。

【0009】更に、インクカートリッジ502をプリントヘッド501から取り外す際に、インク漏れが生じないような対策を取ることが望まれている。そこで、本発明は、インクカートリッジのプリントヘッドに対する装着脱の際に気泡がインクカートリッジ内及びプリントヘッド内に侵入しないようにして、信頼性の高い印刷を可能とすると共に、インクカートリッジをプリントヘッドから取り外す際にインク漏れを確実に防止可能とするインクカートリッジ、プリントヘッド及びインクジェットプリンタを提供することを目的とする。

【0010】

【課題を解決するための手段】上記の課題は、請求項1記載の、インクの供給を受ける供給パイプを有するプリントヘッドに装着されるインクカートリッジであって、連通孔を介して連通しており、インクを貯蔵する第1のチャンバ及び第2のチャンバを有するケーシングと、該第1のチャンバ内に設けられ、インクを負圧で保持するための多孔質体と、該第2のチャンバ内に設けられ、該供給パイプと接続可能な接続部とを備え、該接続部は、通常は閉じており、該供給パイプが該接続部に挿入されると開いて該プリントヘッドと該第2のチャンバとを連通する弁手段を有するインクカートリッジによって達成できる。

【0011】請求項2記載の発明では、請求項1の発明において、前記弁手段の前記供給パイプと接触する部分は、該供給パイプが該弁手段と当接する状態で隙間が生じない形状を有する。請求項3記載の発明では、請求項

1又は2の発明において、前記弁手段は、インクカートリッジのプリントヘッドに対する装着方向に凸の半面球形状を有する弁と、該装着方向とは反対方向に凹の球面形状を有するパッキンと、該弁を該パッキンに対して装着方向に押し付けるバネとからなる。

【0012】請求項4記載の発明では、請求項1又は2の発明において、前記弁手段は、インクカートリッジのプリントヘッドに対する装着方向に凸の半面球形状を有する弁と、Oリングと、該弁を該Oリングに対して装着方向に押し付けるバネとからなる。

【0013】請求項5記載の発明では、請求項3又は4の発明において、前記弁及び前記パッキン又は前記Oリングは、夫々硬度が40度～70度の弹性材料からなる。請求項6記載の発明では、請求項1～5のうちいずれか1項の発明において、インクの残量を検知するために、前記第2のチャンバ内に設けられている複数の電極を更に備えた。

【0014】請求項7記載の発明では、請求項1～5のうちいずれか1項の発明において、一端が前記第1のチャンバと接続し、他端が前記第2のチャンバに接続する流路と、該流路の他端に設けられたフィルタ部材とを更に備え、該フィルタ部材は、インクの残量の減少に伴う前記多孔質体によるインクの負圧保持力の低下をメニスカス力により補う。

【0015】請求項8記載の発明では、請求項7の発明において、前記流路の一端はインクカートリッジのプリントヘッドに対する装着方向とは反対の所定方向に開口して前記第1のチャンバと接続し、他端が該所定方向に開口して前記第2のチャンバに接続する。

【0016】請求項9記載の発明では、請求項7又は8の発明において、前記フィルタ部材は、メッシュが#30～#800の材料からなる。請求項10記載の発明では、請求項7～9のうちいずれか1項の発明において、前記フィルタ部材は、インクとの接触角が5度以上の材料からなる。

【0017】請求項11記載の発明では、請求項7～10のうちいずれか1項の発明において、インクの残量を検知するために、前記第2のチャンバ内に設けられている複数の電極を更に備えた。請求項12記載の発明では、請求項11の発明において、前記電極は、インク切れを検知する状態で、前記第2のチャンバ内に少なくとも1ページの印刷を行うに充分な量のインクが残っているように、該第2のチャンバ内の所定位置に配置されている。

【0018】上記の課題は、請求項13記載の、インクを貯蔵するチャンバを有するケーシングと、該チャンバ内に設けられ通常は閉じている接続部とを有するインクカートリッジが装着されるインクジェットプリンタのプリントヘッドであって、該インクカートリッジの該接続部内に挿入されインクの供給を受ける供給パイプと、ノ

ズルと、該供給パイプから供給されたインクを該ノズルを介して吐出する吐出エネルギー発生素子とを備え、該供給パイプは、該接続部に当接した状態で隙間を生じない形状の先端部と、該先端部に設けられ該接続部内に挿入された状態で該チャンバ内に開口する1又は複数の孔とを有するプリントヘッドによっても達成できる。

【0019】上記の課題は、請求項14記載の、プリントヘッドに対して装着脱可能であり、インクを貯蔵するチャンバを有するケーシングと、該チャンバ内に設けられ通常は閉じている接続部とを有するインクカートリッジを用いるインクジェットプリンタであって、キャリアと、該キャリアに取り付けられて該キャリアと共に駆動されるヘッド部とを備え、該ヘッド部は、1又は複数のプリントヘッドからなり、各プリントヘッドは、該インクカートリッジの該接続部内に挿入されインクの供給を受ける供給パイプと、ノズルと、該供給パイプから供給されたインクを該ノズルを介して吐出する吐出エネルギー発生素子とを備え、該供給パイプは、該接続部に当接した状態で隙間を生じない形状の先端部と、該先端部に設けられ該接続部内に挿入された状態で該チャンバ内に開口する1又は複数の孔とを有するインクジェットプリンタによっても達成できる。

【0020】

【作用】請求項1記載の発明によれば、インクカートリッジをプリントヘッドに装着する際に、気泡がインクカートリッジ又はプリントヘッドに侵入することを確実に防止できると共に、インクカートリッジをプリントヘッドから取り外す際にもインクがインクカートリッジの外部に漏れることを確実に防止できるので、インクジェットプリンタの信頼性を向上することが可能となる。

【0021】請求項2記載の発明によれば、インクカートリッジをプリントヘッドに装着する際に、気泡がインクカートリッジ又はプリントヘッドに侵入することを特に確実に防止することができる。請求項3記載の発明によれば、簡単な構成で、インクカートリッジをプリントヘッドに装着する際に、気泡がインクカートリッジ又はプリントヘッドに侵入することを確実に防止することができる。

【0022】請求項4記載の発明によれば、インクカートリッジをプリントヘッドに装着する際に、気泡がインクカートリッジ又はプリントヘッドに侵入することを特に確実に防止することができる。請求項5記載の発明によれば、供給パイプが弁手段と当接する状態で隙間が発生することを確実に防止できる。

【0023】請求項6記載の発明によれば、高い信頼性で正確にインクの残量を検知することができる。請求項7記載の発明によれば、インクの残量が少なくなつても、インクを負圧で保持することができる。

【0024】請求項8記載の発明によれば、簡単な構成で、インクの残量が少ない場合でもインクを負圧で保持

することができる。請求項9記載の発明によれば、簡単な構成で、インクの残量が少ない場合でもインクを負圧で保持することができる。

【0025】請求項10記載の発明によれば、簡単な構成で、インクの残量が少ない場合でもインクを負圧で保持することができる。請求項11記載の発明によれば、高い信頼性で正確にインクの残量を検知することができ、インク切れを検知した状態での実際のインク残量のバラツキをなくすこともできる。

【0026】請求項12記載の発明によれば、インク切れが検知されてから、少なくとも1ページを完全に印刷することができるので、印刷中に突然インクがなくなる事態が回避できる。請求項13記載の発明によれば、簡単な構成で、インクカートリッジをプリントヘッドに装着する際に、気泡がインクカートリッジ又はプリントヘッドに侵入することを確実に防止できるのでドットぬけが生じることがなく、インクカートリッジをプリントヘッドから取り外す際にもインクがインクカートリッジの外部に漏れることを確実に防止できるので、インクジェットプリンタの信頼性を向上することが可能となる。

【0027】請求項14記載の発明によれば、簡単な構成で、インクカートリッジをプリントヘッドに装着する際に、気泡がインクカートリッジ又はプリントヘッドに侵入することを確実に防止できるのでドットぬけが生じることがなく、インクカートリッジをプリントヘッドから取り外す際にもインクがインクカートリッジの外部に漏れることを確実に防止できるので、インクジェットプリンタの信頼性を向上することが可能となる。

【0028】従って、本発明によれば、インクカートリッジをプリントヘッドに装着する際に、気泡がインクカートリッジ又はプリントヘッドに侵入することを確実に防止できるのでドットぬけは生じず、インクカートリッジをプリントヘッドから取り外す際にもインクがインクカートリッジの外部に漏れることも確実に防止できるのでインクの無駄な消費もさけられ、インクジェットプリンタの信頼性及びランニングコストを向上することが可能となる。

【0029】

【実施例】図1は、本発明になるインクカートリッジの第1実施例を、本発明になるプリントヘッドの第1実施例と共に示す側面図である。図1において、プリントヘッド1はインクを供給するための供給パイプ2とノズル3とを有する。インクカートリッジ11は、着脱レバー5の操作によりプリントヘッド1に対して装着脱可能である。尚、図1では図示を省略するが、インクカートリッジ11をプリントヘッド1に対して装着脱する際に、インクカートリッジ11を案内する案内機構を設けても良いことは言うまでもない。

【0030】図2は、インクカートリッジ11の要部を示す断面図である。同図中、インクカートリッジ11の

ケーシングの上部にはチャンバ12が設けられ、ケーシングの下部にはチャンバ13が設けられている。チャンバ12内には、インクカートリッジ11内のインクを保持するスポンジ14が収納されている。勿論、スポンジ14の代わりに適切な多孔質体を用いても良い。チャンバ13は、プリントヘッド1に供給されるインクを一時的に保持する。これらのチャンバ12、13は、連通孔15を介して連通している。

【0031】この例では、プリントヘッド1の供給パイプ2と接続する接続部16が、チャンバ13の左側に設けられている。しかし、接続部16の位置は、これに限定されるものではない。接続部16には、コイルバネ17、弁18、パッキン19及び板部材20が設けられている。チャンバ13は、通常の状態では、コイルバネ17のバネ力で弁18がパッキン19に密着しているので、インクカートリッジ11の外部に対して密閉されている。従って、この状態では、インクが接続部16を介してインクカートリッジ11の外部に漏れることはない。板部材20は、パッキン19を接続部16に固定するのに用いられている。

【0032】チャンバ13の右側には、一対の電極21a、21bが設けられている。電極21a、21bは、一方ではチャンバ13内に進入しており、他方ではインクカートリッジ11の外部に突出している。電極21a、21bには、例えばパルス電圧が印加され、公知の方法で電極21a、21b間の電位差を検出することにより、チャンバ13内のインクの残量を検知することができる。

【0033】仮に、電極21a、21bがチャンバ12内に設けられていたとすると、スポンジ14に保持されているインクが必ずしも均一に消費されないので、インクの残量の検知を正確に行うことは難しい。つまり、電極21a、21bがチャンバ12内に設けられていると、スポンジ14の一部に多量のインクが停留していることもあり、検知部分でのインク切れに大きなバラツキが生じてしまう。従って、最悪の場合には、インクの残量はまだ充分あると検知されているにも拘らず、印刷中に突然インク切れが発生して印刷不良を起こす可能性がある。

【0034】しかし、本実施例では、電極21a、21bがチャンバ12内ではなく、チャンバ13内に設けられている。つまり、インクの残量の検知をインク、即ち、スポンジ等の多孔質体が設けられていない液体中で行うので、正確にインクの残量を検知することができる。従って、本実施例では、誤ってインク切れを検知したり、インク切れが発生しているにも拘らずインク切れを検知できないといった不都合を生じることなく、常に正確にインクの残量を検知可能である。

【0035】図3は、チャンバ13内のインクの残量を検知する回路の一例を示す回路図である。同図中、ノー

ドN 1 は一方では抵抗2 2 を介して+ 5 Vの電源電圧に接続され、他方では上記電極2 1 a 及び残量検知回路2 3 に接続されている。ノードN 2 は、一方では接地され、他方では上記電極2 1 b 及び残量検知回路2 3 に接続されている。電極2 1 a, 2 1 b 間の抵抗は、チャンバ1 3 内のインクの残量に応じて変化するので、残量検知回路2 3 はノードN 1, N 2 間の電位差を検出することによりチャンバ1 3 内のインクの残量を検知することができる。尚、この様な残量検知回路2 3 自体は公知であるので、その内部構成の図示及び説明は省略する。

【0036】次に、インクカートリッジ1 1 をプリントヘッド1 に装着する場合の動作について、図4 及び図5 と共に説明する。図4 は、プリントヘッド1 の供給パイプ2 の先端がインクカートリッジ1 1 の接続部1 6 と接触する状態を示す側面図であり、インクカートリッジ1 1 の部分は断面で示してある。図5 は、インクカートリッジ1 1 が完全にプリントヘッド1 に装着された状態を示す側面図であり、インクカートリッジ1 1 の部分は断面で示す。

【0037】図4 の状態では、弁1 8 が供給パイプ2 の先端により押されて歪んでおり、弁1 8 と供給パイプ2 の先端との間の隙間がなくなっている。又、パッキン1 9 の形状が供給パイプ2 の先端の形状に対応しているので、空気が弁1 8 及び供給パイプ2 の付近で取り残されることはなく、気泡がインクカートリッジ2 2 のチャンバ1 3 内に侵入することはない。本実施例では、供給パイプ2 の先端のテーパ形状が、パッキン1 9 の下部の開口部でのテーパ形状に対応しており、弁1 8 の下部及びパッキン1 9 の上部は、夫々下に凸の半面球形状と上に凹の球面形状となっている。

【0038】尚、供給パイプ2 の先端の形状、弁1 8 の形状及びパッキン1 9 の形状は、夫々図4 に示すものに限定されるものではない。又、本実施例では、弁1 8 及びパッキン1 9 は柔軟性を有する材料からなるが、気泡のチャンバ1 3 内への侵入を防止できるのであれば、必ずしも柔軟性を有する材料を用いる必要はない。要は、供給パイプ2 がインクカートリッジ1 1 の接続部1 6 と接触している状態で、空気が弁1 8 及び供給パイプ2 の付近で取り残されることがないような形状及び材質を用いれば良い。

【0039】しかし、本実施例では、好ましい形態として、弁1 8 及びパッキン1 9 は夫々好ましくは硬度が4 0度～7 0度のエチレンプロピレンゴムからなる。図4 において、インクカートリッジ1 1 をプリントヘッド1 に対して更に矢印A 方向へ挿入すると、図5 に示す如き状態となる。この状態では、弁1 8 は供給パイプ2 によりコイルバネ1 7 に反して図中上方に押し上げられており、供給パイプ2 の先端に設けられた孔2 a はチャンバ1 3 内で開口する。従って、チャンバ1 3 内のインクは孔2 a を介してプリントヘッド1 に供給される。尚、供

給パイプ2 の孔2 a は、1 つ設けても複数設けても良く、孔2 a の大きさ、形状及び位置は本実施例のものに限定されるものではない。要は、インクカートリッジ1 1 が図5 に示すように完全にプリントヘッド1 に装着された状態で、チャンバ1 3 内のインクが供給パイプ2 の孔2 a を介してプリントヘッド1 に良好に供給されれば良く、孔2 a の大きさ、形状及び位置は使用されるインク等に応じて任意に設定すれば良い。

【0040】インクカートリッジ1 1 は、上記と逆の操作を行うことにより、プリントヘッド1 から取り外すことができる。チャンバ1 3 は、インクカートリッジ1 1 がプリントヘッド1 から取り外された通常の状態では、コイルバネ1 7 のバネ力で弁1 8 がパッキン1 9 に密着しているので、インクカートリッジ1 1 の外部に対して密閉されている。従って、この状態では、インクが接続部1 6 を介してインクカートリッジ1 1 の外部に漏れることはない。

【0041】次に、本発明になるインクジェットプリンタの第1実施例を、図6 及び図7 と共に説明する。図6 はインクジェットプリンタの第1実施例の要部を示す斜視図であり、図7 はヘッド部を示す斜視図である。インクジェットプリンタの第1実施例では、インクカートリッジの第1実施例及びプリントヘッドの第2実施例を用いる。

【0042】図6において、インクジェットプリンタ4 0 は、大略フレーム4 1 、キャリア4 2 、ステージシャフト4 3 、紙送りローラ4 4 、ヘッド部4 5 、バックアップユニット4 6 、モータ4 7 、ベルト4 8 等からなる。キャリア4 2 は、ベルト4 8 と介してモータ4 7 により駆動され、ステージシャフト4 3 に案内されて同図中X 方向へ移動可能である。ヘッド部4 5 は、このキャリア4 2 に取り付けられている。紙5 0 は、紙送りローラ4 4 により送られて、ヘッド部4 5 は例えば上位装置(図示せず) から受信した画像データに基づいて紙5 0 に画像を印刷する。

【0043】バックアップユニット4 6 は、ヘッド部4 5 の保護機構として設けられている。バックアップユニット4 6 は、ヘッド部4 5 が図6 中左側の待機位置にあり、ユーザにより所定の操作が行うと、ドット抜けを防止するためにヘッド部4 5 のノズルからインク及び気泡を吸引して排出させる。

【0044】上記フレーム4 1 、キャリア4 2 、ステージシャフト4 3 、紙送りローラ4 4 、バックアップユニット4 6 、モータ4 7 、ベルト4 8 等からなるインクジェットプリンタ4 0 の部分には、夫々公知の構成を用いることができるので、これらの構造及び動作の詳細な説明は省略する。

【0045】本実施例では、ヘッド部4 5 の構成に特徴があり、ヘッド部4 5 の構成を図7 と共に説明する。図7 は、ヘッド部4 5 をカバーを取り除いた状態で示す。

図7において、ヘッド部45はハウジング51を有し、ハウジング51には複数の着脱レバー5-1～5-5が設けられている。又、ハウジング51の着脱レバー5-1～5-5に対応する位置には、夫々スロット52が設けられている。インクカートリッジ11-1～11-5は、対応するスロット52に挿入され、夫々着脱レバー5-1～5-5の操作により対応するプリントヘッド(図示せず)に対して装着脱可能である。図7では、インクカートリッジ5-1のみがスロット52へ完全に挿入される前又はスロット52から抜き取られる状態で示されている。本実施例では、5つのインクカートリッジ11-1～11-5に対応させて5つのプリントヘッドがハウジング51の下部に設けられているが、図7では見えない。各インクカートリッジ11-1～11-5及び各プリントヘッドは、基本的には図1、図2、図4及び図5と同様の構成を有する。従って、プリントヘッドの第2実施例は、プリントヘッドの第1実施例と同様の構成のものを実質的に複数有する。

【0046】尚、ヘッド部45の内部では、各色のインクについて流路が分割されており、外観上複数になるのは供給パイプの部分だけであり、ヘッドは大別してモノクロ用とカラー用の2つのノズル部分のみからなる。本実施例では、例えばインクカートリッジ11-1～11-4が夫々カラー印刷時に用いられる黒、イエロー、マゼンタ及びシアンのインクを貯蔵している。又、インクカートリッジ5-5は、他のインクカートリッジ11-1～11-4より多少大きく、モノクロ印刷時に用いられる黒のインクを貯蔵している。従って、本実施例では、カラー印刷時とモノクロ印刷時とでは、異なる黒のインクを別々のインクカートリッジから供給する。この様な構成とすることにより、例えばインクカートリッジ11-1～11-4に対応するプリントヘッドとインクカートリッジ5-5に対応するプリントヘッドとに、異なる構造のプリントヘッドを用いることが可能となる。

【0047】具体的には、カラー印刷では多色を使うため、インクの乾きが遅いと紙上で混色してしまうので、溶媒分が多い浸透型のインクが指定紙用として使用される。他方、モノクロ印刷では、一般的にPCC等の普通紙を使うので、このような紙にきれいに印刷するためには、インクが紙にじまない、水分が多くアルコールが添加されたような蒸発型のインクが使用される。

【0048】尚、インクカートリッジ及び対応するプリントヘッドの数は、夫々1以上であれば良いことは言うまでもない。次に、本発明になるインクカートリッジの第2実施例を、図8～10と共に説明する。図8は、インクカートリッジの第2実施例を、本発明になるプリントヘッドの第3実施例と共に示す断面図である。又、図9及び図10は、夫々インクカートリッジの第2実施例及びプリントヘッドの第3実施例の動作を説明する断面図であり、接続部16及びインクカートリッジ61の上

部の図示は省略してある。図8～図10中、図1、図2、図4及び図5と同一部分には同一符号を付し、その説明は省略する。

【0049】本実施例では、図8に示すように、インクカートリッジ61のチャンバ12の下部が一部チャンバ13に入り込んでおり、チャンバ12及びチャンバ13は連通孔15に連通する流路63を介して連通している。流路63は、インクの流れを妨げない構造となっており、一端がチャンバ12へ上向きに開口しており、他端はチャンバ13へ上向きに連通孔15を介して開口している。連通孔15には、フィルタ部材64が設けられている。

【0050】フィルタ部材64は、例えばメッシュが#30～#800では水性のあるステンレス等からなる。又、チャンバ13は、電極21a, 21bに気泡が接触後、フィルタ部材64のメニスカス力でチャンバ13内に保持されるインクの体積が少なくとも約0.05ccとなるような体積に設定されている。

【0051】インクカートリッジ61のチャンバ12内では、図9に矢印で示す如く、スポンジ14によって負圧を発生してインクを保持している。しかし、インクの消費に伴いスポンジ14内のインクの残量が減少すると、図10に矢印で示す如く、流路63及びスポンジ14の中に気泡が混入し、スポンジ14による負圧が消滅する。この結果、スポンジ14によるインクの保持が不可能となる。

【0052】他方、スポンジ14による負圧が消滅すると同時に、フィルタ部材64によってメニスカス力が形成される。このメニスカス力によって発生する負圧により、チャンバ13内にあるインクは保持される。インクが更に消費されると、フィルタ部材64によるメニスカス力も消滅してチャンバ13内にも気泡が混入する。しかし、フィルタ部材64から気泡が離脱した直後に再びメニスカス力が形成されるので、チャンバ13内のインク面がフィルタ部材64より低くなる前まで連続的にインクを負圧で保持することができる。

【0053】インクの残量が著しく減少すると、気泡がチャンバ13の上方に滞留して電極21aに接触し、電極21a, 21b間の抵抗が変化する。従って、この抵抗の変化を図3の如き残量検知回路で検知すれば、インクの残量を正確に検知することができる。

【0054】インクカートリッジ61がプリントヘッド1に装着されていない通常の状態では、図8に示す弁18はコイルバネ17によりOリング66に押し当てられており、インクがインクカートリッジ61の外部へ漏れることを防止している。他方、インクカートリッジ61がプリントヘッド1に装着されると、プリントヘッド1の供給パイプ2が弁18をコイルバネ17のバネ力に反して押し上げ、供給パイプ2の孔2aを介してチャンバ13とプリントヘッド1との間にインクの流路が形成さ

れる。これにより、インクカートリッジ6 1から供給されるインクは、プリントヘッド1の吐出エネルギー発生素子6 8により加圧され、ノズル3からインク滴となって紙（図示せず）等の記録媒体に吐出される。Oリング6 6は、例えば弁1 8と同様の材料からなり、吐出エネルギー発生素子6 8は、例えばピエゾ素子等からなる。

【0055】上記の如く、本実施例では、チャンバ1 2内のスポンジ1 4による負圧が消滅してチャンバ1 3内に空気が混入すると、フィルタ部材6 4によりミニスカスカス力が形成される。この様に形成されるミニスカスカス力が、スポンジ1 4と同等の負圧を発生することができるよう、例えばメッシュが# 3 0～# 8 0 0のメッシュフィルタがフィルタ部材6 4として使用される。又、フィルタ部材6 4の材質は、気泡の離脱が容易に行われるよう、インクとの接触角が約5度以上となるものを使用する。

【0056】フィルタ部材6 4のミニスカスカス力とチャンバ1 3内の圧力がつり合っている場合、チャンバ1 3内のインクは保持される。しかし、インクの消費に伴ってチャンバ1 3内の圧力が低下すると、フィルタ部材6 4のミニスカスカス力が消滅し、チャンバ1 3内に気泡が混入する。フィルタ部材6 4から気泡が離脱した直後には、フィルタ部材6 4により再びミニスカスカス力が形成され、チャンバ1 3内のインク面がフィルタ部材6 4より低くなる前までは、連続的にインクを負圧で保持することができる。気泡は、流路6 3の一端がチャンバ1 2へ上向きに開口しているので、その浮力により大きな気泡に成長する前にフィルタ部材6 4から離脱する。このため、気泡のフィルタ部材6 4からの離脱に伴うチャンバ1 3内の圧力変動を最小限に抑制することができる。

【0057】チャンバ1 3内に入った気泡は、チャンバ1 3の上部に配置されている電極2 1 aに接触し、インクの残量は直ちに図3に示す如き残量検知回路によって検知される。本実施例では、インクの残量がないことが検知された時点で、チャンバ1 3内に最低1ページの印刷を行うのに充分な量のインクが確保されるようになっている。従って、インクの残量がないことが検知された直後でも、フィルタ部材6 4によりインクが負圧で保持されており、印刷中に突然インクが切れることはない。

【0058】次に、1つのプリントヘッド1で最低1ページの印刷を行うのに必要なインクの量の計算方法について説明する。説明の便宜上、テキストの印刷時に必要なインクの量を計算するものとする。1つのノズル3あたりのインク噴射量を50 p 1、インクジェットプリンタの解像度を360 d p i、記録媒体（紙）のサイズがA4=11×8インチ、想定印刷パターンの印刷率が5%とすると、1ページあたりのドット数は、

$$(11 \times 360) \times (8 \times 360) = 11,404,800 \text{ ドット}$$

となり、1ページあたりの使用インク量は、

50 p 1 / ドット × 11,404,800 ドット × 0.05 = 0.028 cc
となる。

【0059】従って、上記の例では、フィルタ部材6 4のミニスカスカス力で保持するインク量は、約2倍のマージンを見込んだ0.05 cc以上を確保することが望ましい。次に、本発明になるプリントヘッドの第4実施例を図1 1と共に説明する。図1 1は、プリントヘッドの第4実施例を本発明になるインクカートリッジの第3実施例と共に示す斜視図である。同図中、図8と同一部分には同一符号を付し、その説明は省略する。

【0060】本実施例では、ヘッド部7 5は4つのインクカートリッジ6 1-1～6 1-4を用いる。これらのインクカートリッジ6 1-1～6 1-4は、夫々黒、イエロー、マゼンタ及びシアンのインクを貯蔵しているので、本実施例ではカラー印刷が可能である。各インクカートリッジ6 1-1～6 1-4は、上部に大気圧解放孔6 9を有し、下部に一対の凸状部分7 0を有する。各インクカートリッジ6 1-1～6 1-4のその他の部分は、上記インクカートリッジ6 1と基本的には同じ構造を有する。

【0061】他方、ヘッド部7 5には4つのプリントヘッド1が設けられ、各インクカートリッジ6 1-1～6 1-4の装着位置に対応させて4対の溝部分7 2が設けられている。各インクカートリッジ6 1-1～6 1-4が対応するプリントヘッド1に装着される際に、凸状部分7 0が溝部分に嵌合して位置決めがなされる。インクカートリッジの装着は、先ず供給パイプ2が接続部1 6（図示せず）内に入るよう上から挿入し、一方の凸状部分7 0を対応する溝部分7 2にはめ込んでからインクカートリッジをヘッド部7 5の移動方向Xに沿って少し動かして他方の凸状部分7 0を対応する他方の溝部分7 2にはめ込む。

【0062】尚、本発明になるインクジェットプリンタの第2実施例は、図6示す如き構成において、ヘッド部4 5の代わりに図1 1に示すヘッド部7 5を用いる。又、上記各実施例を任意に組み合せることも可能であることは言うまでもない。更に、インクの残量を検知するための電極の数は2つに限定されるものではなく、2つ以上の電極を設けても良い。インクカートリッジ内のチャンバの数も、上記各実施例の如く2つに限定されず、2以上のチャンバを設けても良い。

【0063】以上、本発明を実施例により説明したが、本発明はこれらの実施例に限定されるものではなく、本発明の範囲内で種々の変形及び改良が可能であることは言うまでもない。

【0064】

【発明の効果】請求項1記載の発明によれば、インクカートリッジをプリントヘッドに装着する際に、気泡がインクカートリッジ又はプリントヘッドに侵入することを

確実に防止できると共に、インクカートリッジをプリントヘッドから取り外す際にもインクがインクカートリッジの外部に漏れることを確実に防止できるので、インクジェットプリンタの信頼性を向上することが可能となる。

【0065】請求項2記載の発明によれば、インクカートリッジをプリントヘッドに装着する際に、気泡がインクカートリッジ又はプリントヘッドに侵入することを特に確実に防止することができる。請求項3記載の発明によれば、簡単な構成で、インクカートリッジをプリントヘッドに装着する際に、気泡がインクカートリッジ又はプリントヘッドに侵入することを確実に防止することができる。

【0066】請求項4記載の発明によれば、インクカートリッジをプリントヘッドに装着する際に、気泡がインクカートリッジ又はプリントヘッドに侵入することを特に確実に防止することができる。請求項5記載の発明によれば、供給パイプが弁手段と接する状態で隙間が発生することを確実に防止できる。

【0067】請求項6記載の発明によれば、高い信頼性で正確にインクの残量を検知することができる。請求項7記載の発明によれば、インクの残量が少なくなつても、インクを負圧で保持することができる。

【0068】請求項8記載の発明によれば、簡単な構成で、インクの残量が少ない場合でもインクを負圧で保持することができる。請求項9記載の発明によれば、簡単な構成で、インクの残量が少ない場合でもインクを負圧で保持することができる。

【0069】請求項10記載の発明によれば、簡単な構成で、インクの残量が少ない場合でもインクを負圧で保持することができる。請求項11記載の発明によれば、高い信頼性で正確にインクの残量を検知することができ、インク切れを検知した状態での実際のインク残量のバラツキをなくすこともできる。

【0070】請求項12記載の発明によれば、インク切れが検知されてから、少なくとも1ページを完全に印刷することができるので、印刷中に突然インクがなくなる事態が回避できる。請求項13記載の発明によれば、簡単な構成で、インクカートリッジをプリントヘッドに装着する際に、気泡がインクカートリッジ又はプリントヘッドに侵入することを確実に防止できるのでドットぬけが生じることがなく、インクカートリッジをプリントヘッドから取り外す際にもインクがインクカートリッジの外部に漏れることを確実に防止できるので、インクジェットプリンタの信頼性を向上することが可能となる。

【0071】請求項14記載の発明によれば、簡単な構成で、インクカートリッジをプリントヘッドに装着する際に、気泡がインクカートリッジ又はプリントヘッドに侵入することを確実に防止できるのでドットぬけが生じることがなく、インクカートリッジをプリントヘッドか

ら取り外す際にもインクがインクカートリッジの外部に漏れることを確実に防止できるので、インクジェットプリンタの信頼性を向上することが可能となる。

【0072】従つて、本発明によれば、インクカートリッジをプリントヘッドに装着する際に、気泡がインクカートリッジ又はプリントヘッドに侵入することを確実に防止できるのでドットぬけは生じず、インクカートリッジをプリントヘッドから取り外す際にもインクがインクカートリッジの外部に漏れることも確実に防止できるのでインクの無駄な消費もさけられ、インクジェットプリンタの信頼性及びランニングコストを向上することが可能となる。

【図面の簡単な説明】

【図1】インクカートリッジの第1実施例を、プリントヘッドの第1実施例と共に示す側面図である。

【図2】インクカートリッジの第1実施例の要部を示す断面図である。

【図3】チャンバ内のインクの残量を検知する回路の一例を示す回路図である。

【図4】プリントヘッドの供給パイプの先端がインクカートリッジの接続部と接触する状態を示す側面図である。

【図5】インクカートリッジが完全にプリントヘッド1に装着された状態を示す側面図である。

【図6】インクジェットプリンタの第1実施例の要部を示す斜視図である。

【図7】ヘッド部を示す斜視図である。

【図8】インクカートリッジの第2実施例を、プリントヘッドの第3実施例と共に示す断面図である。

【図9】インクカートリッジの第2実施例及びプリントヘッドの第3実施例の動作を説明する断面図である。

【図10】インクカートリッジの第2実施例及びプリントヘッドの第3実施例の動作を説明する断面図である。

【図11】プリントヘッドの第4実施例をインクカートリッジの第3実施例と共に示す斜視図である。

【図12】従来のインクカートリッジの一例をプリントヘッドと共に示す側面図である。

【符号の説明】

- 1 プリントヘッド
- 2 供給パイプ
- 2 a 孔
- 3 ノズル
- 5 操作レバー
- 11, 61 インクカートリッジ
- 12, 13 チャンバ
- 14 スポンジ
- 15 連通孔
- 16 接続部
- 17 コイルバネ
- 18 弁

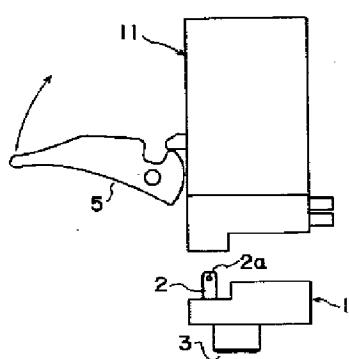
19 パッキン
 20 板部材
 21a, 21b 電極
 23 残量検知回路
 41 フレーム
 42 キャリア
 43 ステージシャフト
 44 紙送りローラ
 45, 75 ヘッド部
 46 バックアップユニット
 47 モータ

【図1】

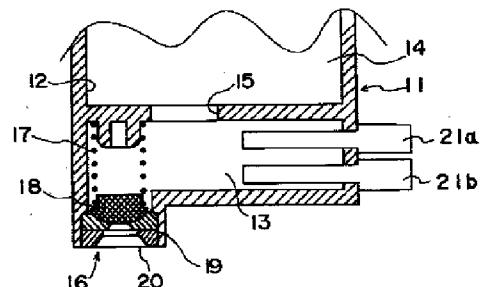
48 ベルト
 50 紙
 51 ハウジング
 52 スロット
 63 流路
 64 フィルタ部材
 66 Oリング
 68 吐出エネルギー発生素子
 69 大気圧解放孔
 70 凸状部分
 72 溝部分

【図2】

インクカートリッジの第1実施例を、プリントヘッドの第1実施例と共に示す側面図



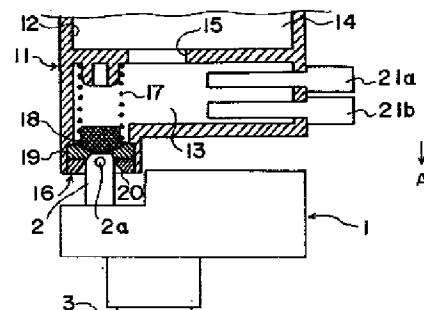
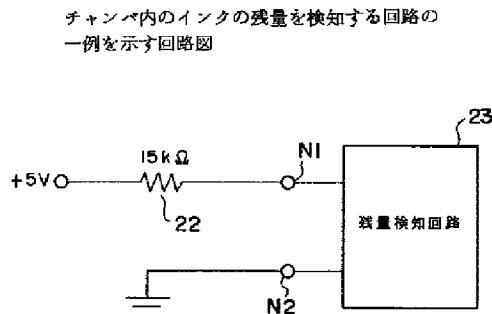
インクカートリッジの第1実施例の要部を示す断面図



【図4】

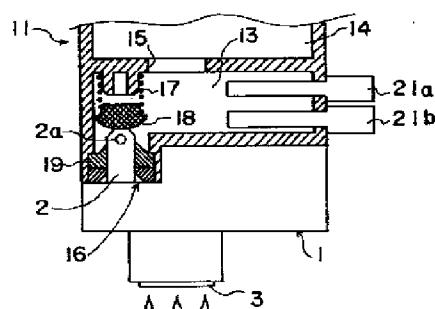
【図3】

プリントヘッドの供給パイプの先端がインクカートリッジの接続部と接触する状態を示す側面図



【図5】

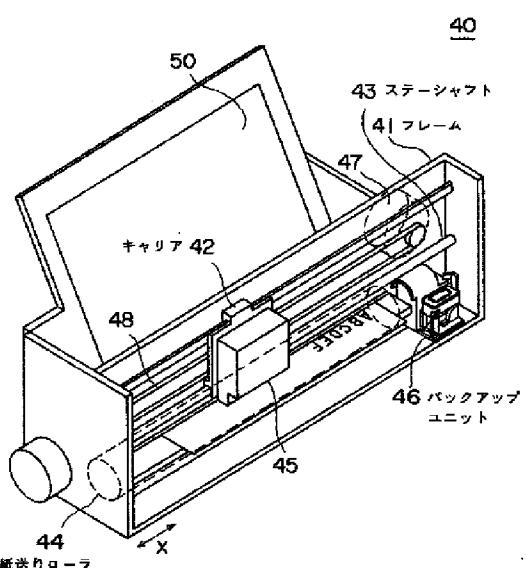
インクカートリッジが完全にプリントヘッド1に装着された状態を示す側面図



【図5】

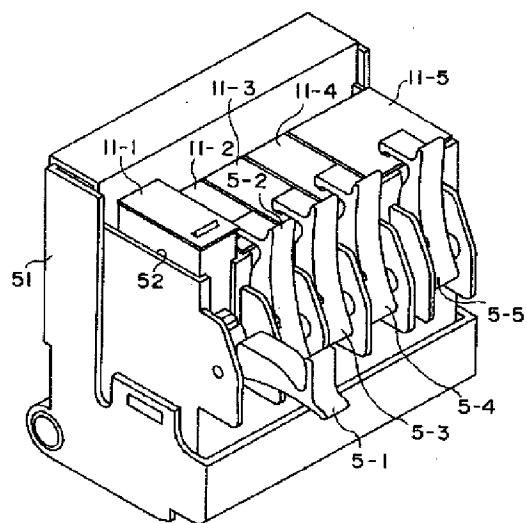
【図6】

インクジェットプリンタの第1実施例の要部を示す斜視図



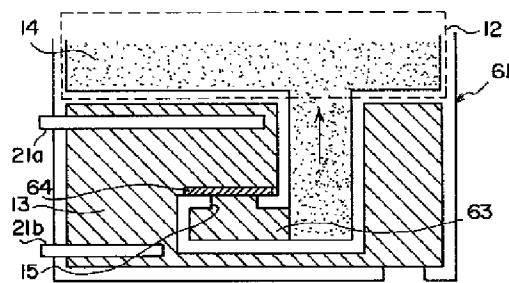
【図6】

ヘッド部を示す斜視図

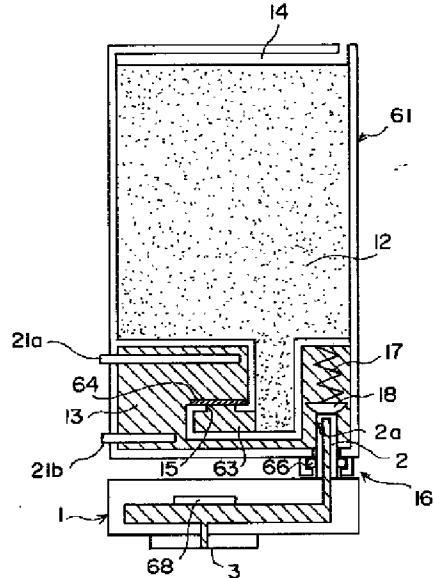


【図7】

インクカートリッジの第2実施例及びプリントヘッドの第3実施例の動作を説明する断面図

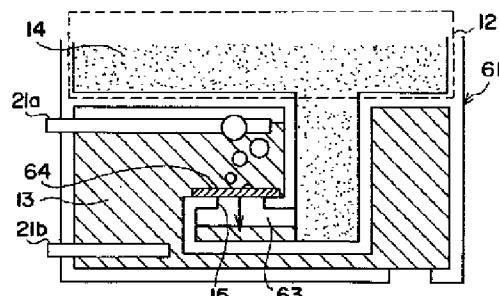


インクカートリッジの第2実施例を、プリントヘッドの第3実施例と共に示す断面図



【図10】

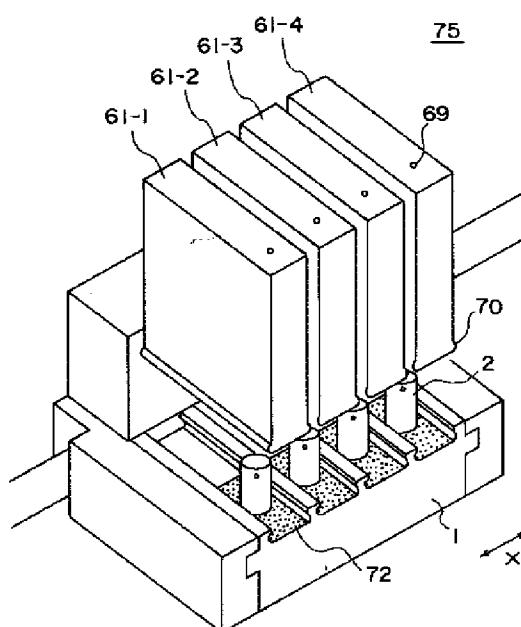
インクカートリッジの第2実施例及びプリントヘッドの第3実施例の動作を説明する断面図



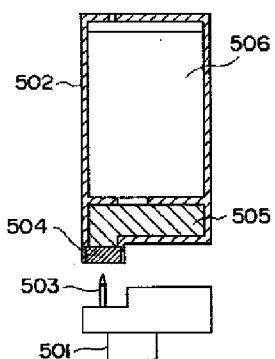
【図12】

【図11】

プリントヘッドの第4実施例をインクカートリッジの第3実施例と共に示す斜視図



従来のインクカートリッジの一例をプリントヘッドと共に示す側面図



フロントページの続き

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